

# MONTHLY WEATHER REVIEW.

Editor: Prof. CLEVELAND ABBE. Assistant Editor: FRANK OWEN STETSON.

VOL. XXXV.

MARCH, 1907.

No. 3

The MONTHLY WEATHER REVIEW is based on data from about 3500 land stations and many ocean reports from vessels taking the international simultaneous observation at Greenwich noon.

Special acknowledgment is made of the data furnished by the kindness of cooperative observers, and by R. F. Stupart, Esq., Director of the Meteorological Service of the Dominion of Canada; Señor Manuel E. Pastrana, Director of the Central Meteorological and Magnetic Observatory of Mexico; Camilo A. Gonzales, Director-General of Mexican Telegraphs; Capt I. S. Kimball, General Superintendent of the United States Life-Saving Service; Commandant Francisco S. Chaves, Director of the Meteorological Service of the Azores, Ponta Delgada, St. Michaels, Azores; W. N. Shaw, Esq., Director Mete-

orological Office, London; H. H. Cousins, Chemist, in charge of the Jamaica Weather Office; Rev. L. Gangoiti, Director of the Meteorological Observatory of Belen College, Havana, Cuba.

As far as practicable the time of the seventy-fifth meridian is used in the text of the MONTHLY WEATHER REVIEW.

Barometric pressures, both at land stations and on ocean vessels, whether station pressures or sea-level pressures, are reduced, or assumed to be reduced, to standard gravity, as well as corrected for all instrumental peculiarities, so that they express pressure in the standard international system of measures, namely, by the height of an equivalent column of mercury at 32° Fahrenheit, under the standard force, i. e., apparent gravity at sea level and latitude 45°.

## FORECASTS AND WARNINGS.

By Prof. E. B. GARRIOTT, in charge of Forecast Division.

### AN UNSEASONABLE WARM PERIOD IN THE UNITED STATES.

The temperature of the third decade of March averaged 12° to 21° above the normal generally east of the Rocky Mountains. In the Eastern States this remarkable and probably unprecedented 10-day period of March heat was due to the passage of two well-marked warm waves that advanced from the Great Plains to the Atlantic coast. These warm waves had their origin in a heated area that set in over the Middle-western and Southwestern States from the 16th to the 18th, and continued in that region for about ten days, with maximum temperatures of 90° to 100° in Oklahoma and Kansas. The first offshoot from this heated area advanced over the Mississippi Valley on the 21st and reached the Atlantic coast on the 22d, attended at many points by the highest temperatures on record for March. At Washington, D. C., 90°, or higher, was reached on three days, the highest, 93°, being registered on the 23d. This was 10° above the highest March temperature previously recorded for Washington. The second warm wave of this decade advanced from the eastern Rocky Mountain slope to the Atlantic coast from the 24th to 29th, with temperatures at many points that exceeded those of any previous March. On the 29th the heated area in the Middle West and Southwest was dissipated by an area of high barometer from the Pacific. This high area was attended by a cold wave that carried the frost line to northern Florida by April 1.

The associated apparent causes of periods of unusual weather are found in the abnormal distribution of barometric pressure over and near the regions affected. In the case of the March warm period the barometer was continuously low or falling over the western half of the United States from the 18th to 28th. Attending the eastward advance of the warm wave on the 21st and 22d, pressure was low over the entire country except the extreme southeast. On the 24th the warm period in the Eastern States was temporarily broken by a high barometer area that moved from the Hudson Bay region over the Atlantic States from the 24th to 27th. In the meantime barometric pressure had remained low in the West. Following the southeast passage of the Hudson Bay high area southerly winds with rapidly rising temperature again set in over the eastern districts, and continued until broken by the cold wave of the 30th. A consideration of the greater areas of barometric pressure shows that during this warm period pressure was exceptionally high for the season over the interior of Asia, and corre-

spondingly low over the north Pacific Ocean. The effect of continued low pressure over the northern Pacific is shown in the low pressures that continued over central and western portions of the American Continent, which were in turn responsible for the prevalence of warm southerly winds over the eastern half of the United States during the latter half of the month.

Aside from the warm period referred to, average winter temperatures prevailed over the eastern half of the country. In Maine and the Pacific States the month was colder than usual, and over the northern half of California the deficiency was 3° to 6°.

### IN GENERAL.

No specially notable features were shown by European and central Asiatic reports. There were two interruptions of the high barometric pressure that prevails at this season over the interior of Asia, one in the first decade and the other at the close of the month. In each case there appeared to have been a slow eastward drift of low barometric pressure from west-central and northwestern Europe, and from the Iceland low area, where, at Seydisfjord, readings below 29.00 inches were recorded during brief periods in each decade. British Isles pressures were generally high, except from the 15th to 19th and at the close of the month, when disturbances of marked intensity crossed that region. In the vicinity of the Azores the barometer was exceptionally high during the first half of the month, and readings did not fall below 30.00 inches until the 31st. Over the western Atlantic storms advanced from the northern coasts on the 2d to 4th, 6th, 20th, and 23d, the storm of the 20th being particularly severe on the New England and Canadian coasts. The passage from the continent of storms of moderate strength caused low barometric pressure at Bermuda on the 6th, 25th, and 26th. A feature of the closing days of March was a storm off the extreme southeast coasts of the United States. As this storm acquired its greatest intensity early in April, its description will appear in the MONTHLY WEATHER REVIEW for that month.

A number of disturbances of moderate energy crossed the Great Lakes, one in the first and third decades and four in the second decade of the month. On the Pacific coast barometric pressure was generally low, more especially during the second and the first half of the third decades, the lowest reading, about 29.15 inches, being noted on the north Washington coast on the 23d.

Precipitation was in excess in the Rocky Mountain and Plateau districts and thence over California and southern Oregon. In California the month was one of the wettest Marches on record.

Heavy rains in the second decade of the month caused exceptionally high stages in the Ohio River and tributaries. At Pittsburg, Pa., a stage of 35.5 feet was reached on the morning of the 15th. This is the highest stage of water ever recorded at Pittsburg, and exceeded the record stage of February 10, 1832, by 0.5 foot. The water at Pittsburg receded rapidly after the 15th, until the 19th, when another rainstorm caused a rise to 24.4 feet, 2.4 feet above the flood stage, at 5 p. m. on the 20th. Heavy rains that set in on the Pacific coast on the 16th and continued several days, combined with melting snow in the mountains, caused destructive floods in the Sacramento Valley, Cal.

The night of the 5th a heavy snowstorm, attended by high wind, thunder and lightning, visited the Middle Atlantic States. On the 10th a heavy snowstorm covered the Middle Atlantic and New England States and the Canadian Maritime Provinces.

#### BOSTON FORECAST DISTRICT.

Storms of notable severity occurred on the 11th, 19th, and 20th. On the 19th heavy snow fell in northern New England, and on the 20th the wind attained velocities on the coast of 35 to 77 miles an hour. Storm warnings were timely, and there was no damage and little delay to shipping.—*J. W. Smith, District Forecaster.*

#### NEW ORLEANS FORECAST DISTRICT.

Frost warnings were issued on two days and frost occurred in the section covered by the warnings. Frost occurred over limited areas, without warnings, on two days. Cold-wave warnings were not issued or required, and no general storm occurred on the Gulf coast.—*I. M. Cline, District Forecaster.*

#### LOUISVILLE FORECAST DISTRICT.

After the 13th exceptionally warm weather prevailed, and day after day March temperature records were broken. The month closed with a cold wave and killing frost, regarding which due warnings were issued. The flood in the Ohio River caused widespread damage, altho in this vicinity damage was not so great as from the January flood.—*F. J. Walz, District Forecaster.*

#### CHICAGO FORECAST DISTRICT.

The special features of the month were extremely high temperatures over practically the entire district, with no cold waves of consequence. Advisory messages were sent to open ports on Lake Michigan previous to the occurrence of storms, and no damage by storms is known to have occurred.—*H. J. Cox, Professor and District Forecaster.*

#### DENVER FORECAST DISTRICT.

March was wet west of the Continental Divide and dry on the eastern slope, with an excess of temperature thruout the district. In eastern Colorado the month was the mildest March on record. No cold-wave warnings were issued.—*F. H. Brandenburg, District Forecaster.*

#### SAN FRANCISCO FORECAST DISTRICT.

Unusually heavy precipitation caused destructive floods in central and northern portions of California. Storm warnings were necessary on a number of dates. There were some frosts, but fewer than usual.—*A. G. McAdie, Professor and District Forecaster.*

#### PORTLAND, OREG., FORECAST DISTRICT.

The month was not as stormy as usual. During a storm on the 22-23d maximum velocities of 74 miles at North Head, Wash., and 60 miles at Tatoosh Island were reported. No marine casualties were reported in connection with the storms of the month. Timely warnings were issued for all damaging frosts.—*E. A. Beals, District Forecaster.*

### RIVERS AND FLOODS.

For the second time within the short period of two months the Ohio Valley was visited by a great flood. The flood waters from the great rise of January had scarcely past into the Mississippi before the rains that were to cause another began over the headwaters. The two floods differed materially in character in that above the mouth of the Great Kanawha River that of January was very moderate, while that of March was decidedly the reverse, so much so in fact that stages beyond all previous records were reached at Pittsburg and along the Youghiogheny River generally. The apparent antecedent conditions of the two floods were not greatly dissimilar, except that over the watershed of the Conemaugh and Kiskiminetas, the lower Youghiogheny, and the upper Allegheny rivers there were from 4 to 8 inches of moist, heavy, and comparatively fresh-fallen snow on the ground on March 10 and 11, whereas immediately preceding the flood of January there was little or none. The amount of rainfall was somewhat greater during the January flood, but in March differences in distribution, combined with high temperatures and the rapid melting of the snow over the Allegheny, Kiskiminetas, and Youghiogheny watersheds, caused a volume of water that more than compensated for the deficiency in the amount of precipitation.

The greater portion of the heavy rains fell on two successive days, the 13th and 14th, just at the time when, under the influence of temperatures that were from 10° to 25° above normal conditions, all the snows over the Allegheny and Monongahela watersheds were melting with great rapidity and running into the streams.

From the mouth of the Great Kanawha to the mouth of the Scioto the crest stages of the two floods were very nearly alike, as were also the periods of duration. Below the mouth of the Scioto the crest stages of March were from 1 to nearly 5.5 feet below those of January, on account of the limited supply of water contributed by the southern tributaries, notably the Great Kanawha, the Big Sandy, and the Guyandotte. This deficiency in the precipitation over the State of West Virginia is probably all that prevented a flood of much greater proportions. The headwaters of all northern tributaries were above flood stages, and had the West Virginia tributaries, with the Big Sandy, contributed their usual proportionate share of water, the flood of February, 1884, might easily have been compelled to yield its precedence, at least below the mouth of the Great Kanawha River.

The damage caused by the flood was approximately as follows:

Pittsburg, Pa. ....	\$5,600,000
Parkersburg, W. Va. ....	200,000
Cincinnati, Ohio. ....	200,000
Louisville, Ky. ....	100,000
Interior Ohio. ....	1,500,000
Total .....	\$7,600,000

To these figures must be added the expense of moving property beyond reach of the flood waters, as well as the losses occasioned by the interruption of business, so that the total damage must have amounted to at least \$8,000,000.

An inspection of the weather maps and special reports shows that the flood at Pittsburg can be attributed mainly to the enormous volumes of flood waters caused by the excessive rains and melting snows from March 12 to 14 over the Kiskiminetas and Youghiogheny watersheds. The Monongahela, of course, contributed largely, but not so much as in the January flood, when the stages above the mouth of the Youghiogheny were from 3 to 5 feet higher. Not nearly so much rain fell over the upper Allegheny, less than 1 inch in fact, and no water of consequence came from the region above the mouth of the Kiskiminetas until the afternoon and evening of

March 14, when the breaking of the 6 or 8 feet of ice at Parker, Pa., released the backed-up water and augmented the flood volume of the lower river by about a foot or two. Preliminary warnings were issued on the morning of March 13 and special reports ordered from substations. By this time heavy rains and thunderstorms had interrupted the telegraph and telephone service so that it was impossible to obtain complete reports, and as a consequence the labor of issuing further flood warnings was attended with great difficulties. At 8 a. m. March 14 the stage of water at Pittsburg was 31.1 feet, having past the flood stage of 22 feet between 6 and 7 p. m. on the previous day. At the same time Johnstown, Pa., on the Conemaugh-Kiskiminetas reported 18 feet, 11 feet above flood stage, and the highest stage since the great flood of May 31, 1889. All previous records were exceeded on the Youghiogheny River, West Newton, Pa., reporting 26.3 feet, flood stage being 23 feet. The rise continued until 5 p. m., when a crest stage of 28.2 feet was reached, 6.2 feet above previous high records.

The river continued to rise at Pittsburg until 5 a. m., March 15, when a crest stage of 35.5 feet was reached, exceeding by 0.5 foot the previous high record of February 10, 1832, and by 2.2 feet the high-water mark of February 6, 1884. By 8 a. m., March 16, the river had fallen to 22.8 feet, and by 9 a. m. was once more below the flood stage.

In accordance with custom the municipal authorities of the cities of Pittsburg and Allegheny rendered extremely valuable assistance in the local dissemination of the flood warnings. Squads of police visited every house in the low-lying districts ordering the inhabitants to remove their property to places of safety, and all kept in close touch with the local Weather Bureau office.

About 4000 telephone calls were answered during the three days of the flood, and more than 1000 persons called at the office in search of information. The damage done in the immediate vicinity of Pittsburg amounted to about \$5,600,000, falling principally upon the manufacturing and electrical industries. As far as is known nine deaths in the Pittsburg district can be attributed to the flood, three by the collapse of a railroad bridge, and six by drowning in small streams. The damage to the river interests was practically nothing. Other losses above Pittsburg can not be satisfactorily estimated. On the morning of March 14 warning was also sent to Wheeling, W. Va., to expect a stage of 48 feet, 12 feet above the flood stage, by the afternoon of March 15, and again at 1 a. m., March 15, for a stage of 50 feet by midnight of the same date. The crest stage was 50.1 feet at 9 p. m. of the 15th.

This flood has resulted in the overturning of all precedents, and has established the fact that while the Allegheny is usually the prime factor in flood causation at Pittsburg it is not essentially so. In the present instance the bulk of the water undoubtedly came from the Youghiogheny, which was ably, but not so extensively, assisted by the Kiskiminetas and Monongahela. The Allegheny was quite sluggish, being backed up for many miles above Pittsburg, and contributed practically no water to the main flood volume until late in the afternoon of March 14, when the moving of the ice above permitted a little water to come thru.

The greatest previous flood at Pittsburg was that of February 10, 1832, when the water reached a stage of 35 feet, 0.5 foot below that of the present year. Mr. Henry Pennywitt, official in charge of the local office of the Weather Bureau at Pittsburg, has furnished the following extracts regarding this flood:

From the Pittsburg Gazette:

[Issue of February 10, 1832.] River in fine order, about 15 feet above low-water mark.

[Tuesday morning, February 14.] The winter commenced several weeks earlier than usual. On the 9th of January the ice broke up and navigation opened. On the 5th of February it began to rain, and continued to rain with slight interruptions until the night of the 9th. On

the 9th the rivers commenced to rise, and continued rising rapidly and regularly until 9 p. m. of Friday, the 10th, "when they were higher than had been known by any living inhabitant of this city or neighborhood". The whole of the low ground of the boroughs of the Northern Liberties and Allegheny and the greater part of the city of Pittsburg north of Liberty street were inundated. The damage in Pittsburg did not equal that in those boroughs. No estimate approaching accuracy can be made of the damage at this time.

[Tuesday, February 21.] The damage was less than at first estimated. At Pittsburg the crest was at 10 p. m., Friday, and at Wheeling, 8 p. m. Saturday.

#### From the History of Allegheny County:

The winter of 1831 set in early in November and the rivers were frozen until February, 1832, so that people were able to cross on the ice. There was some snow, enough for tolerably good sleighing, but not enough either in Pittsburg or on the mountains to give token of a large spring freshet. Albach, in his *Annals of the West*, says: "A winter of excessive cold was closed suddenly by long continued and very heavy rains, which, unable to penetrate the frozen ground, soon raised every stream emptying into the Ohio to an unusual height. The main trunk, unable to discharge the water which poured into it, overflowed its banks and laid the whole valley, in many places several miles in width, under water. The water continued to rise from the 7th to the 19th of February, when it attained a height of 63 feet above low-water mark at Cincinnati". Albach's statement of long continued and very heavy rains is not strictly correct. The rain which began to fall early in February, 1832, was a gentle, warm rain, not a very heavy one. It fell upon frozen ground, melting what little snow there was, and ran off as fast as it fell. The rains continued long enough to cause every tributary of the Ohio to overflow its banks. The rivers broke up on the 10th and had begun to fall on the 14th. Allegheny was covered with water to where the Fort Wayne road crosses Federal street. "The Point" at Pittsburg was from four to six feet under water, and the water extended to St. Clair street on Penn and Liberty. Wood street was overflowed as far as Fourth avenue. All communication between the town and the South Side was cut off.

Yet beyond the flooding of cellars and lower rooms, no special damage was done to Pittsburg. The people living near the rivers were inconvenienced for a time, and business was at a standstill for a few days, but a few weeks served to remedy all this inconvenience. The greatest material loss to Pittsburg was that of Smoky Island, which was carried away, together with a frame factory which it contained.

From the mouth of the Beaver River to Parkersburg, W. Va., the flood was remarkable for its unprecedented rate of rise, averaging 30 feet for the forty-eight hours ending at 8 a. m., March 15, and the stages were the highest of record, with the exception of those of February, 1884. In the Parkersburg district the stages were generally somewhat over 50 feet, Parkersburg reporting 51.6 feet, 15.6 feet above the flood stage, and Marietta, Ohio, 50.6 feet, 25.6 feet above the flood stage. Warnings were issued promptly, but in several instances they were not heeded as they should have been, some persons preferring to place more reliance upon previous experience than upon the actual knowledge in the possession of the Weather Bureau. As a consequence considerable damage was done that might have been avoided. The official warnings were characterized by extreme accuracy, and were the subject of much commendation.

Four lives were lost during the flood and the damage done amounted to about \$200,000.

From Parkersburg to Cairo conditions were very similar to those that prevailed during the flood of January, 1907, altho from Portsmouth, Ohio, southward, the crest stages were somewhat lower. The warnings were issued with the usual high degree of accuracy, and many letters of commendation were received. The damage done amounted to perhaps \$300,000 or \$400,000, considerably less than during the January flood.

A special hydrograph of the Ohio River, showing the stages from day to day, will be found on Chart IX.

The Wabash River was also in flood, with crest stages of 17.3 feet at Terre Haute, Ind., and 23 feet at Mount Carmel, Ill., on March 19 and 22, respectively, flood stages being at 16 and 15 feet. Warnings were issued from time to time and the crest stages differed from the forecast stage by only 0.4 foot.

While the flood was in progress along the upper Ohio, the interior rivers of the State of Ohio, without exception, were

also in flood, and an enormous amount of damage was done over the southern half of the State.

The following table contains the flood stages at the various stations, together with the crest stages of both the January and March floods, and the number of days the river was above the flood stage:

Station.	Flood stage.	Crest stages.		Days above flood stage.	
		January, 1907.	March, 1907.	January, 1907.	March, 1907.
Pittsburg, Pa.	22	23.2	35.5	1	4
Wheeling, W. Va.	36	36.9	50.1	2	4
Parkersburg, W. Va.	36	40.1	51.6	6	6
Point Pleasant, W. Va.	39	50.2	54.8	9	10
Huntington, W. Va.	50	58.0	58.4	7	7
Catlettsburg, Ky.	50	60.0	60.4	8	7
Portsmouth, Ohio.	50	61.0	60.8	9	9
Maysville, Ky.	50	60.3	59.2	9	9
Cincinnati, Ohio.	50	65.2	62.1	11	12
Madison, Ind.	46	56.7	51.9	10	10
Louisville, Ky.	28	41.4	36.0	11	11
Evansville, Ind.	35	46.2	44.8	30	17
Mount Vernon, Ind.	35	48.5	45.0	31	16
Paducah, Ky.	40	45.7	42.3	16	10
Cairo, Ill.	45	50.4	46.2	16	9

At Hamilton the Great Miami River reached a stage of 20.3 feet, 8.3 feet above the flood stage, and within 0.9 foot of the highest water of record. From 3 to 9 a. m., on March 13, the river rose 10 feet.

Along the Scioto River conditions were still more pronounced. At Circleville the crest stage was 19.3 feet, 12.3 feet above the flood stage, the breaking of a levee alone preventing still higher stages. At Columbus the maximum stage was 19 feet, 2 feet above the flood stage. Similar conditions prevailed along the Muskingum River, and at Zanesville on March 14, the water reached a stage of 31.9 feet, 6.9 feet above the flood stage.

The Hocking River, altho quite small, really caused more damage than any other river in the State. The Hocking Valley Railroad suffered to the extent of \$170,000, the loss to the coal mines by flooding was about \$1,000,000, and a few small towns were nearly destroyed. Nothing serious occurred along the Sandusky and Maumee rivers, altho flood stages were general. The total damage in the State of Ohio caused by the floods, aside from that along the main river, amounted to at least \$1,500,000, and possibly more.

Warnings were issued from the local office of the Weather Bureau at Columbus, Ohio, on March 14 and 15 to all points likely to be affected by high water, and reports from flooded districts stated that they were the means of saving a great amount of property.

The crest of the Ohio River flood past into the Mississippi on March 24, and as it closely followed another rise moving slowly toward the Gulf, the two were in a measure merged into one long swell with a very leisurely movement. At the end of the month the river was above flood stage as far south as Arkansas City, and still rising slowly below. Advisory warnings were issued at the proper time in both the Memphis and Vicksburg districts. The only damage was caused by the overflow of some early seeded fields along the lower Yazoo River, but planting operations were generally delayed and levee work entirely suspended.

There were some heavy rains along the Cumberland and lower Tennessee rivers during the last day or two of February and the first two days of March, necessitating warnings of moderate floods which were well verified. No damage was done.

Flood waters caused by ice gorges did much damage along the Missouri River between Pierre, S. Dak., and Sioux City, Iowa, during February and early March, and the following report thereon was prepared by Mr. C. D. Reed, official in charge of the local office of the Weather Bureau at Sioux City, Iowa:

A warm spell from February 9 to 17, over the region between the Missouri River and the Rocky Mountains, caused all the tributaries flowing into the Missouri from the west and the headwaters of the Missouri itself to break up with more than the usual volume of water, the snow-fall in this region having been above normal. On February 15, the Bad River broke up suddenly at Fort Pierre, S. Dak., pushed large quantities of ice out over and under the solid ice in the Missouri, and flooded the lowlands on the Fort Pierre side, damaging barges and other property belonging to the U. S. Engineers, to the amount of \$3000. At about the same time, the White River broke suddenly and rose rapidly near Oacoma, S. Dak., causing a loss of live stock and farm buildings estimated at \$3000.

On Sunday, February 17, the Missouri began to break up from just above Sioux City to above Running Water, S. Dak. Altho above the normal February stage, the Missouri was yet 5 feet below flood stage at Sioux City and at Yankton. Without some stoppage in the movement of the ice, no flood damage could possibly have occurred, but during the forenoon of February 17, the ice began lodging on a sand bar in Gundersen's Bend, four miles southeast of Vermillion, S. Dak. In five hours the water rose 12 feet and began flowing over the bottom lands. By Monday morning the 18th the water had broken thru the Chicago, Milwaukee, and St. Paul Railroad grade between Vermillion and Burbank, and began flooding the land north of the track. It is reported that the current was so strong that huge cakes of ice were carried over the railroad and into the fields on the other side.

At 10 p. m. of the 17th, upon the meager and somewhat conflicting information that could be gathered from unofficial sources, warnings were issued to interests on lowlands in the vicinity of Sioux City, advising the removal of all live stock to higher ground at once and the preparation of movable property for transfer on short notice. On the following morning this warning was distributed at Jefferson, and Elk Point, S. Dak., and Jackson, Nebr.:

"Gorge in Missouri River threatens damaging flood. Every precaution should be taken on lower lands."

During the afternoon of the 18th, a portion of the gorge became detached and past down to Renniker's Neck opposite Jackson, Nebr., where it lodged, causing the water to overflow the banks. A new channel was soon cut and much of the ice remained stranded. During the afternoon of the 18th heavy ice began passing Sioux City and while not really forming a gorge, it clogged the channel just below the mouth of Big Sioux River, causing the water to back up that river so that it began to flow into the basements of some of the boat club houses at Riverside, and came within an inch of the grates under the boilers used in heating Elder's greenhouses. An estimated stage of 14 feet occurred at the Sioux City gage during the night of the 18-19th.

After the partial break in the gorge at Vermillion on the 18th it rapidly reformed, and during the next few days extended up the river past Vermillion a total distance of 10 or 12 miles. The ice in many places became piled up to a height of 10 to 15 feet above the water level, and a few huge cakes became tipped up on edge so that they stood 25 feet high. The water spread over a large territory on both sides of the river, but especially on the South Dakota side from below Burbank to above Meekling. It is estimated that 100 square miles of land not usually overflowed were inundated, and much of this was valuable farming land. Within about ten days the water cut channels around and thru the gorge and began to subside gradually. The breaking up of the Missouri at Pierre, S. Dak., on March 7, with a 3-foot rise, closed the outlets around the gorge to some extent, and a second rise occurred on the 9th and 10th of March, reaching about the same height as the previous rise and extending farther up the river, causing additional damage at Meekling and above.

At this time an effort was made by the U. S. Engineers to locate a point where the gorge could be effectively blasted away with gunpowder, but before a strategic point could be found, large sections from the lower end of the gorge began to break away and pass down the river at intervals. The main gorge began to move out at 3 p. m. of the 13th. As it past Vermillion the water rose 3 feet, remained stationary for a time, and then rose 4 feet more, due to a sudden stoppage of the gorge at some point below. The U. S. Engineers telephoned the local office of the Weather Bureau in Sioux City as to the breaking of the gorge and the total rise of 7 feet in six hours. On this information and because of the great probability of a sudden stoppage of the gorge at most any point below, it was deemed advisable to issue flood warnings for Jefferson and Elk Point, S. Dak., and Jackson and Walker's Island, Nebr., and interests in Sioux City affected by a stage of 17 feet. The warnings were all distributed before midnight of the 13th. An estimated stage of 14.5 feet occurred at Sioux City on the early morning of the 14th. As the ice moved out without stoppage, all danger of flood was soon past.

The flood in the vicinity of Vermillion continued twenty-four days, and was said by old residents to be the worst since March 25, 1881, when a gorge formed in a similar manner at about the same place. The total damage is estimated at \$100,000, of which probably \$20,000 might have been prevented if sufficient warning could have been given. On account of the caprices of ice gorges and the difficulty in securing reliable information from points between gage stations, the difficulty in accurately predicting such floods is obvious.

The flood in the Sacramento and San Joaquin valleys was doubtless the greatest in their history, and before the waters subsided damage amounting to at least \$5,000,000 had been done. An account of this flood has been prepared by Mr. James H. Scarr, official in charge of the local office of the Weather Bureau, Sacramento, Cal., and follows herewith:

Preliminary to a report on the great flood of the latter half of March, 1907, in the Sacramento and lower San Joaquin valleys, a glance at the rainfall tables of the climatological reports of the California section will serve to show a period of heavy and long-sustained precipitation extending from the 2d to the 17th of January. Then followed a nearly rainless period of a week, followed by another period of heavy precipitation, extending from January 24 to February 4. During these periods the rainfall was unusually heavy over the Sacramento watershed, gradually diminishing toward the south with heavy and accumulating snows in the higher Sierras.

These periods of heavy precipitation are mentioned because of their effect on the later flood situation in the Sacramento watershed. Conditions in the San Joaquin were not materially affected by these rains.

The precipitation of the first period mentioned produced the ordinary winter stages in the rivers of the Sacramento watershed, and the great overflow areas or storage basins known as Sutter, American, and Yolo basins began to fill.

The precipitation of the second period, ending about February 4, produced flood stages in all the streams of the Sacramento watershed, tho no new high-water records were made, except at Marysville, where the Yuba recorded a stage of 22.2 feet on February 2, 21.8 feet being the previous record.

On February 2 the American River at Folsom reached a stage of 21.2 feet, the highest known for many years. All local interests were warned by telephone. Two new railroad bridges in process of construction across the American River at this city were in great danger, but the companies' officials were warned in time to take all possible precautions, and as a result most of the structures were saved. By courtesy of the Capital and Pacific States Telephone companies all down-river points were warned of a rapid rise and advised to patrol all levees. Advisory warnings were sent to all points on the Sacramento from Colusa to Rio Vista daily as the situation seemed to warrant, and all local transportation interests were kept fully advised.

This flood wave in the upper Sacramento crested at Kennett on February 4 at 18.5, at Red Bluff on the 4th at 24.4, at Colusa on the 6th at 28.2, and at Knights Landing on the 6th at 18.8 feet. Below the latter place most of the flood waters of both the Sacramento and the Feather escape into the Yolo basin, returning to the Sacramento at Rio Vista thru Cache slough. At this city the Sacramento River continued to rise till the evening of the 8th, when at a stage of 26.9 feet the levee on the west side of the river opposite Y street (the south boundary of the city) broke, flooding a small district in Yolo County containing some 900 acres. The Southern Pacific Railroad grade cuts off the upper or northern end of this district, passing thru the village of Washington. A small portion of the town lying south of the railroad was flooded. The back levees of the district were cut to save the railroad grade, and the water quickly found its way to the Yolo basin on the west. With the occurrence of this break the river here began to decline steadily.

On the 7th the first of the flood wave was noticed in a one-foot rise at Rio Vista. A warning was sent that flood stages would probably be reached by the 12th. The river reached its highest stage of 13.3 feet at Rio Vista about noon of the 11th.

This flood did very little damage, but is interesting in this connection because it left the great storage basins full. The warnings issued were generally appreciated and eagerly sought by those whose interests are menaced by flood stages.

The lower San Joaquin River reached a fairly high stage, 15.8 feet, on the 9th, but as this is not dangerously high no warnings were sent. The daily river bulletin reaches Stockton at noon, and is ample to advise of stages in that watershed except in case of great emergency.

The rest of February was generally deficient in precipitation. The rivers declined to the usual winter stage and remained about stationary, responding slightly to a short precipitation period from the 21st to the 25th.

March shows two distinct precipitation periods—the first from the 2d to the 11th, only moderately heavy, but depositing fresh snow on the high mountains and well down on the foothills; the second extending from the 16th to the 25th and being very heavy. From the 16th to the 20th, inclusive, this rainfall over the northern half of the State, and especially in the watersheds of the upper Sacramento, Feather, Yuba, Bear, American, Mokelumne, Calaveras, Stanislaus, and Tuolumne rivers and over the watersheds of Stony, Cache, and Putah creeks, on the west side of the Sacramento Valley, was accompanied by unusually warm weather, especially at the higher altitudes, causing rapid melting of the soft snow and a run-off probably the heaviest since these valleys have been inhabited by civilized people. The average precipitation of four stations on the upper Sacramento for these five days is 8.90; for nine stations in the watershed discharging thru the Feather River 16.56; for six

stations in the American watershed 14.41; and for four stations along the eastern slope of the San Joaquin watershed 6.99 inches.

Individual stations reporting the greatest precipitation were Stirling City, 24.22 inches during this period, and 43.38 for the entire month; and Laporte 22.45 inches during this period, and 42.62 for the entire month.

The effect of this rainfall was immediate and extreme in all rivers affected. At Kennett, on the upper Sacramento, the river rose from 6.3 on the 17th to 20.0, 25.0, and 33.2 feet on the succeeding days; while in the Feather, Yuba, American, Mokelumne, Calaveras, Stanislaus, and Tuolumne, the climax was reached one day earlier.

On Sunday, the 17th, reports from Electra, Melones, and Jacksonville of stages of 8.0, 10.3, and 10.6 feet, respectively, warranted a warning advising of a sudden and extreme rise in tributaries of the San Joaquin and subsequent high stages in the main river. An advisory warning was also sent to Colusa on the strength of special report of heavy rainfall at Kennett, and all local interests were warned by telephone of a sudden and extreme rise in the American River.

On Monday, the 18th, conditions were rapidly growing worse in all sections of both watersheds. Special reports were called for from stations in the San Joaquin watershed and warnings were repeated to Stockton, to be distributed by special arrangements from that point. Advisory warnings were sent to Colusa and Marysville, and all local interests advised thru the courtesy of the telephone companies.

On Tuesday, the 19th, telegraph wires were down in many places, but on the showing of reports received in a regular way, and reports of rainfall by courtesy of the Southern Pacific Company, warnings were sent to Colusa to expect the highest water of record at all points from Kennett to Knights Landing. Warnings were sent to Stockton for highest water of record in the Tuolumne, Stanislaus, Calaveras, and Mokelumne rivers also that the lower San Joaquin and entire island district would experience the highest water of record after the 21st. The American River at Folsom crested at 26.8 feet this morning. It was learned later that the Yuba at Colgate crested at midnight on the 18th at 23.0 feet, 8.4 feet above the previous high-water stage of February 22, 1904. The Feather at Oroville crested on the morning of the 19th at 28.2 feet, 3.2 feet above the previous high-water stage of February, 1881. The Yuba at Marysville also crested on the morning of the 19th at 23.3 feet, 1.1 feet above the high-water record of February 2, 1907; the Mokelumne River at Electra at 13.0 feet, 4.0 feet above the previous highest known stage; the Calaveras at Jenny Lind at 13.0 feet, 3.0 feet above previous high water, and the Tuolumne at Jacksonville at 26.0 feet, by several feet the highest of record. The Stanislaus at Melones also reached a stage of 11.0 feet on the 19th, being above all previous records, tho it crested at 12.2 feet on the 21st.

On the afternoon of the 10th water from the Calaveras River overflowed the greater portion of the city of Stockton. The flood reached its greatest height about midnight, and in two or three days the water was gone from the streets. No lives were lost. The damage is estimated at half a million dollars, one half that sum being charged to goods in basements and lower floors damaged by wetting.

On Wednesday the 20th, the river at Kennett reached the remarkably high stage of 33.0 feet, 8.0 feet above any previously known stage, and began falling rapidly. At Red Bluff the flood wave crested at 27.5 feet at 4 p. m., 2.0 feet below the highest record stage of February 4, 1881. Colusa reported a stage of 28.6 feet, but 0.1 foot below the high-water stage of April 1, 1906, and with a certainty of a continued rise for twenty-four hours, unless relieved by breaking and overtopped levees. A special message at 4 p. m. announced a stage of 29.3 feet, with water running over the levees both above and below the city. Levees were also overtopped for nearly the whole distance from Princeton to Jacinto. At 8 p. m. another special message announced the inevitable breaking of the levees below Colusa, affording at least temporary relief to the levees in front of the city. All reports from the Feather River watershed showed declining stages. The American at Folsom declined 6 feet, but was still at an unusually high stage. The Sacramento at this place reached 26.9 feet, and began to decline. The slope of the water surface from the mouth of the American to the Kripp break, a distance of nearly 3 miles, was about 2 feet to the mile, and the current velocity was estimated by engineers and river men to be at least 12 miles an hour. It was evident that no flood stage could occur here under the conditions existing, but warnings to points on the river between here and Rio Vista were emphasized. The doubled current velocity here was forcing a much larger volume of water past the Kripp break than would have past that point at much higher stages at normal velocity. The break was also acting to reduce the slope of the flood plane below, and a consequent "piling up" of the water below was resulting not only in higher stages than would be indicated by the stage at Sacramento, but higher stages by several feet than were ever before recorded.

The river at Rio Vista began to respond to the flood waters on this date in a rise of 1 foot to a stage of 9.8 feet at 7 a. m., and warnings were issued that the river at that point would continue to rise till after Sunday and would pass all previous high-water records.

The San Joaquin crested at the bridge near Lathrop at 19.2 feet, 0.5 foot above the high-water mark of March 25, 1906. Long distance telephone calls were had from Stockton and other down-river points, and warnings and advices were distributed by this means. The Mokelumne

River near Woodbridge was reported to have broken its levees, and a large area was being flooded.

On Thursday the 21st, Kennett reported a decline of over 12 feet. Breaks had occurred near Princeton, and several breaks in Sutter County had flooded Reclamation District No. 70, resulting in the loss of considerable stock. Telephone lines were down and it was impossible to reach the district with the later warnings. Eleven breaks had occurred on the west side between Colusa and Grimes, and the river at Colusa was falling. At Knights Landing the river crested on this date at 20.2 feet, 1 foot above the previous high-water record. Breaks occurred in the levees above and below the town, flooding the greater part with back water. No lives were lost and not a great amount of damage was done in the town. The Feather, Yuba, and American rivers were falling. The Sacramento was falling at this city, but rising at all points below, including Rio Vista, where the returning flood waters from Yolo basin thru Cache slough caused a rise to a stage of 13.2 feet. All rivers in the San Joaquin watershed were falling except the San Joaquin at Firebaugh, the fall to a stage of 18.6 feet at the bridge near Lathrop being due to several breaks in the levees both above and below that point. Long distance telephone calls from Stockton, Elk Grove, Rio Vista, Walnut Grove, Isleton, and Courtland furnished means of repeated warnings that the rivers and sloughs of the island districts would continue to rise for several days, and would remain at dangerously high stages until after the 29th. San Francisco was asked for a special wind forecast at 4 p. m., and the following was received: "High southwest winds will prevail in the valley and Bay districts to-night and Friday morning". This warning was telephoned or telegraphed to all points that could be reached; under prevailing conditions it was deemed of the utmost importance, as wave action under strong wind pressure is apt to prove most destructive to nearly submerged levees. During the night several breaks occurred between Courtland and Walnut Grove on the east side of the Sacramento. This water past down on the back side of the Pierson district, adding to the already disastrous overflow from the Mokelumne, and threatening all reclamations in the lower San Joaquin delta.

On Friday, the 22d, most interest centered on the island districts, where the water continued to rise steadily. Rio Vista reported 15.5 feet, 0.5 foot above the high-water mark of March 23, 1904. The situation was growing desperate, but the only reply that could be given to the repeated telephone calls from the doomed reclamations was: "The worst is yet to come. Do not be deceived by a temporary decline on the ebbing tide. The water will rise steadily in most sections till after Sunday, and the danger will not be past for a week". Several districts in the San Joaquin delta, embracing more than 20,000 acres, were flooded. District No. 108, embracing 75,000 acres, mostly in Colusa County, gave way and began to fill rapidly.

Saturday, the 23d, was a most disastrous day. Ryer, Tyler, Brannan, Andrus, and Bouldin islands and the Lisbon district, embracing some 60,000 acres, all in the highest state of intensive cultivation, were flooded. This wholesale inundation, with the outgoing tide, caused a slight decline at all points on the Sacramento side, but warnings were repeated that a still further rise would occur at all points in the island district. On Sunday, the 24th, the river at Rio Vista reached its highest point, 18 feet, 3 feet above the previous high-water record, and began to decline. This decline was doubtless due to the breaking of the levees on Brannan, Andrus, and Twitchell islands. The water from the Yolo basin thru Cache slough was given a direct and free outlet to the San Joaquin instead of being confined to the narrow and crooked channel between Sherman Island and the Solano County hills. On this date the rich Pierson district, some distance below this city, which escaped the flood of 1904, and which by tremendous effort had so far been held, gave way, and 10,000 more acres of the most productive land in the world was given to the flood. Probably the largest loss of livestock occurred in this district, its value being estimated at \$60,000. This was not because of the lack of warning, but because the officers of the reclamation district were too confident of holding the district against all odds.

The breaking of Brannan, Andrus, and Twitchell islands now gave the waters from the Yolo basin, which were several feet higher than ever before known, a free sweep in an almost direct line from the outlet at Cache slough into the San Joaquin more than 75 miles above its mouth. The escaping water from the Sacramento in the vicinity of Courtland also found a direct outlet into the San Joaquin still higher up. As a result the water in the San Joaquin and sloughs below Stockton continued to rise in some sections till the 29th, tho at Lathrop the highest was reached on the 20th. In this section probably 40,000 acres were flooded after the 24th, the last tract of 2000 acres being submerged on the 29th.

To summarize, undoubtedly the flood of March 18 to 29, 1907, was the greatest since the lowlands of the Sacramento and San Joaquin valleys have been reclaimed to any considerable extent. It is probable that the volume of water discharged was equal to if not greater than that of 1862, referred to as the "great flood".

Nearly 300,000 acres of reclaimed land was flooded. The damage, including the loss of crops, which is far in excess of all other losses combined, will probably reach \$5,000,000. This does not include damage to railroads which was considerable. Very few lives were lost, and none

can be charged directly to the flood, so far as present advices indicate.

All previous high-water records were surpassed at all points reporting on the Feather, Yuba, and Bear rivers, also at all points on the Sacramento River, except Red Bluff and Sacramento. The Mokelumne, Calaveras, Stanislaus, and Tuolumne rivers past all previous records, as did also the San Joaquin below the mouth of the Tuolumne.

In judging of the service performed by the Weather Bureau in this emergency, it is hoped that it will be born in mind that this service embraces two entire river systems, each complicated and with sources of flood waters from numerous short, torrential streams. The situation in the most important part, viz, the island districts, is still further complicated by the union of the two systems at tide level by an intricate network of sloughs and channels, and the return to the main rivers by shorter routes of the escaped flood waters from above. Then again the service is comparatively new as regards administration, data secured, and the people and interests to be served.

The papers usually gave credit for the information furnished and repeated the warnings given, and the editors and reporters have personally expressed great appreciation of the service. Locally the State Board of Public Works, the transportation companies, and many owners of reclaimed lands have also expressed appreciation of the service rendered.

Our observer at Colusa writes:

"All farmers in flooded sections had received warnings from the Weather Bureau, and had ample time to remove stock to places of safety. No stock lost in Colusa County. \* \* \* A copy of all warnings furnished to the press and posted on Market street and on Fifth street, and all farmers accessible by telephone notified. The service furnished by the Weather Bureau very satisfactory and greatly appreciated by all interests".

M. D. Eaton, of Stockton, to whom was sent the first warning on March 17, writing on the 18th, says:

"\* \* \* I immediately telephoned, upon the receiving of your telegram, to different parties interested in reclaimed lands which might be affected by the possible extreme flood waters of the San Joaquin. It would be useless for me to say that we appreciate your action beyond any explanation. \* \* \* Your telegram of yesterday created quite a stir among us and has given us an opportunity to prepare for dangerous waters".

J. M. Eddy, Secretary of the Stockton Chamber of Commerce, writes under date of April 4:

"In behalf of this Chamber of Commerce and the vested interests of this community, I wish to thank you for your successful efforts to keep this organization and our people apprised of the river stages and weather conditions during the recent floods, and to assure you that there is a very high appreciation of your work among those best informed and most concerned. I trust that the memory of this will influence our citizens to a greater degree of helpfulness to you in making your inquiries in the future".

In addition to the service rendered, the complete and unbroken record of river stages secured by this service during the flood will prove invaluable to all lines of hydrographic, reclamation, irrigation, and river improvement work.

The breaking up and downstream passage of the ice in both branches of the Susquehanna River resulted in some moderately high stages of water, but no damage of great consequence. At Binghamton, N. Y., the ice went out at 11 p. m. on March 15; at Towanda, Pa., at 10:30 a. m. of the same day, and at Wilkes-Barre, Pa., at 5 a. m., March 16, moving out on 16 feet of water.

At Clearfield, Pa., on the West Branch, the ice began to move at 6 p. m., March 13, and by 5 p. m. of the following day the water had reached a stage of 11.9 feet, 3.9 feet above flood stage. Several factories were compelled to suspend work for a few days, and some streets were washed out.

At Renovo, Pa., the ice went out at 7 a. m. on March 14, and at Williamsport, Pa., at 6 a. m. of the following day. In the main river the ice began to run on March 14.

The greatest damage was done at Port Deposit, Md., a large portion of which was flooded.

The dead body of a boy, found in the ice at Port Deposit, was afterward identified as that of one who had fallen into the North Branch from the Berwick Bridge, more than 150 miles above, on January 16, 1907.

Warnings of the stages of water to be expected were issued from Harrisburg, Pa., on March 13 and 14, and were of great benefit to those interested.

Considering the condition of the rivers, the manner of the ice breakup was most fortunate; first came the ice from the main river and the Juniata, then that from the West Branch,

followed a day later by that from the East Branch. Had all or any two come out together, a serious flood in the lower river would surely have resulted.

The rains of the latter days of February and March 1 caused a moderate flood in the Alabama River, and others somewhat more pronounced in the Black Warrior, the lower Tombigbee, and the rivers of southeastern Mississippi. Warnings were issued for all, and no damage worthy of special mention was done. On some of the rivers the floods were of benefit, as they permitted the movement of lumber that had been held for sufficient water to float it to market.

The heavy rains on March 13 and 14 caused severe and dangerous floods along the upper Potomac River and its headwaters, resulting in damage to the amount of about \$1,000,000, mainly to railroad interests. There was no damage of consequence below Cumberland, Md.

High water did some damage along the rivers of Idaho, the result of heavy rains and melting snows.

At the end of the month the Mississippi River was free from ice, which broke up at Leclaire, Iowa, on March 1, and at Fort Ripley, Minn., on March 27.

The rivers of Maine remained frozen, but the ice of the upper Connecticut gave way between March 27 and 29.

The highest and lowest water, mean stage, and monthly range at 312 river stations are given in Table VI. Hydrographs for typical points on seven principal rivers are shown on Chart I. The stations selected for charting are Keokuk, St. Louis, Memphis, Vicksburg, and New Orleans, on the Mississippi; Cincinnati and Cairo, on the Ohio; Nashville, on the Cumberland; Johnsonville, on the Tennessee; Kansas City, on the Missouri; Little Rock, on the Arkansas; and Shreveport, on the Red.—H. C. Frankenfield, *Professor of Meteorology*.

### SPECIAL ARTICLES, NOTES, AND EXTRACTS.

#### RAINFALL AND RUN-OFF OF THE CATSKILL MOUNTAIN REGION.<sup>1</sup>

By THADDEUS MERRIMAN, Assistant Engineer. Dated Browns Station, N. Y., June 14, 1906.

The purpose of the studies on the rainfall and run-off of the Catskill watersheds, the results of which are embodied in this report, has been:

1. To determine the most probable mean annual rainfall on each of the four watersheds proposed to be used as an additional supply for the city of New York.
2. To determine the relation between the values of the rainfall on these watersheds and the values of the rainfall at other points where long and careful records have been kept.
3. To determine as closely as possible the percentage of the rainfall on these watersheds which may be expected to appear as streamflow and become available for the supply of the city.

#### RAINFALL.

An examination of rainfall records in the State of New York, particularly in the territory covered by the Rondout, Esopus, Schoharie, and Catskill watersheds, at once showed that practically no observations had ever been made in this immediate vicinity. There was found but one record within the limits of these watersheds, and that for a short period only. A number of records had been kept at distances varying from 3 to 20 miles, and located geographically around the area under consideration. An admirable digest of these records in the vicinity was made in the report of the Commission on Additional Water Supply for the city of New York, in 1903. This commission also established a number of gages on these watersheds. Observations were continued for about nine months, when the completion of the work of the commission caused their abandonment.

Ten rain gages have been established by the present Board of Water Supply, and these, in connection with the gages of the voluntary observers of the United States Weather Bureau, cover in excellent form all the territory of the four watersheds. For the future, therefore, the rainfall will be determined with a high degree of precision.

In order to fix the most probable mean value of the rainfall in this territory it was decided to make the study as comprehensive as possible. To this end, therefore, nearly all reliable records for points within approximately one hundred miles of the Ashokan basin which could be found in public documents were gotten out and studied. This work involved an examination of the records at 76 different stations, the records at all of the stations covering a total length of 1085 years.

The records studied were obtained from the following sources: (a) New York State Meteorology. (b) The New York

State Weather Bureau Reports. (c) The United States Weather Bureau Reports. (d) Records at miscellaneous points, as given in the report of the Commission on Additional Water Supply.

In the New York State Meteorology are assembled the records of observations made at the incorporated academies of the State, under the direction of the regents of the University of the State of New York. These records were begun in 1825 and carried on more or less continuously until the Civil War diverted attention from them, and they were forgotten.

Two different forms of gages were employed by these old-time observers. Prior to 1833 a gage with but little protection against evaporation was used. A conical mouthpiece collected the rain and delivered it into a cylinder the area of which was one-eighth that of the mouth of the collecting cone. In this cylinder there was a float connected to a graduated scale which projected above the top of the gage, and on which the depths were read. In cold weather a vessel having the same area of mouth as the collector of the gage was set out. The snow was caught in this vessel, melted, and measured in the gage. This vessel was not more than 6 inches deep, and it is doubtful if the precipitation during the winter months, as determined by this device, was even of a reasonable degree of accuracy. In fact, an inspection of these records shows that the rainfall during the winter season was then apparently quite uniformly lower than that which is recorded by gages at the present time; there is no reason for believing that such was really the case, and the difference is to be attributed to the type of gage used.

The instructions for setting these gages stated that they should be set remote from all obstacles, and distant from them by at least twice the height of the obstacle.

After 1833 a conical type of gage was used, the details of which are shown in the accompanying sketch.<sup>2</sup> Measurement of the rainfall was made by putting a graduated stick down into the gage. This stick was graduated so as to give a reading in hundredths of an inch for the first three-tenths of an inch, and thereafter by fifths of an inch. The instructions for the setting of these gages were the same as those for the older type, except that they were to be placed with their mouths 8 feet above the surface of the ground.

All of these old records indicate quite uniformly a lower value for the rainfall than do the results of more recent observations. While it is impossible to state absolutely the reasons for this apparent difference, it is probably due (1) to loss by evaporation from the first type of gage used; (2) to the unapproved method of measuring the snowfall; (3) to the placing of the conical gage 8 feet above the ground; this gage would therefore probably register about 3 per cent less rain than the standard gages now in use.

<sup>1</sup> A report to C. E. Davis, department engineer, and J. Waldo Smith, chief engineer, Board of Water Supply, city of New York. Communicated by permission of the Board.

<sup>2</sup> Not reproduced here.—EDITOR.

On the other hand, however, there is nothing to indicate that these reports were not kept with the greatest care and fidelity. They show monthly rainfalls as high as any we have now, and others just as low. Were it not for the unfortunate differences in methods used, these records would be of very great value. In these studies they have been used as having an indicative value only.

The records obtained from the reports of the New York State Weather Bureau and from those of the United States Weather Bureau are the most valuable and reliable which can be obtained. The methods used by the observers reporting to these two bureaus are uniform, and the only question which can arise as to their reliability is that of the unfaithfulness of the observers. This naturally is something which can not be considered.

To attempt to assign a relative value to the records of all the stations studied would be a hopeless and impossible task. They have, therefore, been studied collectively; i. e., when in one locality one record showed a very high value and another a low one the mean of the two records has been considered as being the most probable value of the rainfall in that vicinity. Having decided that this was the only practical method of treating the records studied, it was felt that before even this could be done they must be reduced to some more even plane. The following is the reasoning which was used in this deduction, the steps of which are shown in detail in Tables 1 and 2.

Rainfall is erratic, and follows no definitely recognized law. Records of rainfall may differ from each other on account of what we may term "accidents of location", such, for instance, as the inapparent effect of a building; or again, the location of the gage in the path of showers, which path is defined by the topography of the country; or the results may differ, as from a minor local storm, which is felt at one station and not at another. That such differences occur is well shown by a study of the contemporaneous rainfalls at New York and Newark, 10 miles distant from each other, and again at Albany and Troy, but 7 miles apart. These very visible differences led us to an extended study, and we observed that they occur usually in the months of June, July, August, September, and October. Those which occur in June, July, and August are probably the result of local thundershowers, while those of September and October seem to be due to extended storms which cover a wide area of country, yet in which the precipitation varies greatly, even over a limited portion of territory. Other differences, not numerous, however, occur in the other months of the year, but the reasons for them are not so apparent.

Having recognized and admitted this principle of permissible differences in the records, the following method of rendering them comparable presented itself. Any monthly rainfall which exceeds twice the monthly mean rainfall for the length of the record is an excessive or unusual rainfall, and should be eliminated from the record. This has been done in the following manner: In any month in which the rainfall exceeded twice the monthly mean, as before defined, the value used for that month was the monthly mean, unless the rainfall for either the preceding or the following month was less than one-half its monthly mean, in which case only the excess of the surplus of the one month over the deficiency of the two months was deducted. The value of the yearly rainfall so determined has been called the "mean annual dependable" rainfall. It is not felt that this method of treating the records departs from sound and logical principles. It is without doubt a conservative assumption, and for that reason has recommended itself most strongly.

Rainfall, according to the best of our knowledge, varies in irregular cycles. It appears to be manifestly improper, therefore, to compare even the mean annual dependable rainfall at one station with that at another without reducing them both

to an even plane by correcting them after comparison with the contemporaneous rainfalls at one or more points where records have been kept both for a long period and in an efficient manner. New York and Newark on the south, and Albany and Troy on the north, seemed to answer this purpose, and, following still further the method of elimination of differences in record due to local conditions, the mean annual dependable rainfalls for New York and Newark were averaged, and the resulting value called the mean annual dependable rainfall in the vicinity of New York. Similarly, the values of the mean annual dependable rainfall at Albany and Troy were averaged and called the mean annual dependable rainfall in the vicinity of Albany.

The values of the mean annual dependable rainfall at all stations studied have therefore been increased or diminished as the mean annual dependable rainfall in the vicinity of New York and in the vicinity of Albany varied above or below its mean during the years of the record in question. Two values for the deduced mean annual dependable rainfall at each station were thus obtained, and their mean was taken as most probably giving the best value. The full detail of this method is shown in Table 2. The value for the rainfall so determined has been called the "deduced mean annual dependable rainfall".

In the foregoing treatment the probability that the rainfall at any station within a given area varies from its mean by practically the same percentage as does the rainfall at any other station within the area has been made use of. In substantiation of this principle, Table 3 is presented. This table indicates that this proposition is true for 72 per cent of the time within the area covered by the records studied, and it may be added that the smaller the territory under consideration the more nearly does it become absolute.

Having obtained the values of the deduced mean annual dependable rainfall as before described, even they did not appear to be proper values to use for the purpose of drawing isohyetal lines on a map of the region, for the reason that the mean annual dependable method had practically eliminated all local characteristics. In Table 1, therefore, will be found the number of unusual years, the records of which have been modified by this method. The percentage which the number of these unusual years is of the length of the record was then determined, as also the difference between the mean annual and the mean annual dependable precipitation. The product of this percentage and this difference was then added to the deduced mean annual dependable precipitation in order to determine finally the most probable value of the mean annual rainfall.

This value having been determined, it was plotted for all stations, and the isohyetal lines drawn as shown on the map, fig. 1. In studying these lines in connection with the values of the rainfall in Table 1, it must be borne in mind that the old records were given an indicative value only, and that where two neighboring stations showed different values for the rainfall the mean of these two values was taken as being the best value for that vicinity.

These lines indicate that the most probable values of the mean annual rainfall for the four watersheds under consideration are as stated in the first column of the following table of probable rainfall:

Watershed.	Map.	Additional water supply.	U. S. Weather Bureau.
	Inches.	Feet.	Inches.
Rondout.....	48	49	47
Esopus.....	44	46½	43
Schoharie.....	41	42	39
Catskill.....	39	39½	37

For purposes of comparison the values for the mean annual rainfall on these watersheds, as deduced by the Commission on Additional Water Supply, and the values as determined from

the curves of mean annual rainfall published in the annual summary for 1905 of the New York section of the Climate and Crop Service of the United States Weather Bureau, are also given.

TABLE 1.—Showing all the stations for which records have been studied, the time of these records and their length, the number of extraordinary falls occurring during the life of the record and the percentage which such occurrences are of the length of the record, the mean annual precipitation as usually deduced, the mean annual dependable precipitation and the difference between them, the deduced mean annual dependable precipitation and a quantity which is the product of the percentage of the extraordinary falls and the difference between the mean and mean dependable precipitation; this quantity is properly added to the mean annual deduced dependable precipitation in order to give finally a most probable value for the mean yearly rainfall.

Place.	Time of record.	Length of record.	Number of extraordinary falls.	Per cent of extraordinary falls.	Mean annual precipitation.	Mean annual dependable precipitation.	Difference.	Deducted mean annual dependable precipitation.	Quantity to be added.	Probable mean yearly rainfall.
		Yrs.			Inch.	Inch.	Inch.	Inch.	Inch.	Inch.
New York, N. Y.	1836-1905	70	23	33	45.86	43.71	2.15	43.71	0.71	44.42
Newark, N. J.	1844-1904	61	15	25	47.57	44.62	2.95	44.62	0.74	45.36
Albany, N. Y.	1825-1904	80	24	30	38.89	37.31	1.58	37.31	0.47	37.78
Troy, N. Y.	1826-1886	59	17	29	36.45	35.18	0.64	35.18	0.19	35.37
Croton watershed, N. Y.	1868-1904	37	14	38	49.04	46.73	2.31	46.73	0.88	47.61
Pequannock, N. J.	1893-1905	13	4	31	50.84	47.71	3.13	47.71	0.97	48.68
Le Roy, Pa.	1889-1905	17	2	12	40.66	40.12	0.54	40.12	0.06	40.18
Dyberry, Pa.	1866-1898	33	0	0	39.00	39.00	0.00	39.00	0.00	39.00
Blooming Grove, Pa.	1866-1894	27	14	52	43.68	39.80	3.88	39.80	2.02	41.82
Towanda, Pa.	1896-1905	10	1	10	35.66	35.20	0.46	35.20	0.05	35.25
Easton, Pa.	1857-1905	48	8	17	45.68	43.71	1.97	43.71	0.61	44.32
Mauch Chunk, Pa.	1890-1905	15	3	21	50.29	48.74	1.55	48.74	0.33	49.07
South Easton, Pa.	1890-1905	16	1	6	38.32	37.99	0.33	37.99	0.02	38.01
Salem Corners, Pa.	1870-1899	30	0	0	48.39	48.39	0.00	48.39	0.00	48.39
Bethlehem, Pa.	1878-1903	26	6	23	44.06	42.19	1.87	42.19	0.43	42.62
Coopersburg, Pa.	1890-1900	11	1	9	47.29	46.48	0.81	46.48	0.07	46.55
Wilkes-Barre, Pa.	1885-1905	20	4	20	40.28	38.84	1.44	38.84	0.35	39.19
Honesdale, Pa.	1882-1894	13	3	23	45.64	41.75	3.89	41.75	0.89	42.64
Belvidere, N. J.	1892-1904	12	3	25	47.33	45.48	1.85	45.48	0.50	45.98
River Vale, N. J.	1893-1904	12	2	17	50.27	48.62	1.65	48.62	0.28	48.90
Englewood, N. J.	1896-1904	8	2	25	52.22	49.70	2.52	49.70	1.01	50.71
Paterson, N. J.	1892-1904	13	3	23	51.79	49.86	1.93	49.86	0.44	50.30
Dover, N. J.	1886-1905	20	8	40	51.29	47.72	3.57	47.72	1.43	49.15
Canton, Conn.	1889-1904	16	6	38	51.35	48.53	2.82	48.53	1.07	49.60
Waterbury, Conn.	1889-1904	15	8	53	50.78	46.82	3.96	46.82	2.10	48.92
New Haven, Conn.	1887-1904	18	6	33	45.29	42.73	2.56	42.73	0.84	43.57
Hartford, Conn.	1888-1904	16	6	40	51.24	48.28	2.96	48.28	1.18	49.46
Hawleyville, Conn.	1899-1904	6	3	50	52.60	49.08	3.52	49.08	1.76	50.84
Amherst, Mass.	1887-1904	18	3	17	45.09	43.95	1.14	43.95	0.24	44.19
Monson, Mass.	1890-1904	14	4	29	46.48	44.75	1.73	44.75	0.50	45.25
Williamstown, Mass.	1885-1904	20	14	70	39.39	37.27	2.12	37.27	0.85	38.12
Manchester, Vt.	1888-1904	16	1	6	43.96	43.33	0.63	43.33	0.11	43.44
Jacksonville, Vt.	1889-1904	15	8	53	48.06	43.58	4.48	43.58	2.78	46.36
Kinderhook, N. Y.	1830-1846	17	4	24	36.19	35.17	1.02	35.17	0.24	35.41
West Point, N. Y.	1843-1899	56	20	36	46.55	43.78	2.77	43.78	1.16	44.94
Kingston, N. Y.	1829-1892	63	8	13	39.28	37.64	1.64	37.64	0.57	38.21
Kingston Reservoir, N. Y.	1900-1905	6	3	50	48.41	44.77	3.64	44.77	1.82	46.59
Poughkeepsie, N. Y.	1830-1899	69	11	16	38.09	36.16	1.93	36.16	0.89	37.05
Oxford, N. Y.	1829-1905	76	7	9	40.81	39.80	1.01	39.80	0.18	40.00
Hudson, N. Y.	1827-1855	28	5	18	39.18	36.20	2.98	36.20	0.77	36.97
Hartwick, N. Y.	1826-1850	24	2	8	37.31	36.63	0.68	36.63	0.10	36.73
Hamilton, N. Y.	1827-1895	68	19	28	34.12	33.26	0.86	33.26	0.18	33.44
Cooperstown, N. Y.	1854-1905	52	10	19	39.81	38.92	0.89	38.92	0.17	39.09
Granville, N. Y.	1835-1848	13	3	23	31.86	30.65	1.21	30.65	0.28	30.93
Fairfield, N. Y.	1828-1848	20	5	25	36.69	34.90	1.79	34.90	0.55	35.45
Cherry Valley, N. Y.	1827-1845	18	4	22	41.31	40.31	1.00	40.31	0.29	40.60
Rome, N. Y.	1890-1904	15	5	33	47.06	44.84	2.22	44.84	0.84	45.68
Wappingers Falls, N. Y.	1891-1905	15	5	33	50.36	46.60	3.76	46.60	1.24	47.84
Middletown, N. Y.	1891-1905	15	3	20	45.73	42.99	2.74	42.99	0.90	43.89
Cortland, N. Y.	1851-1905	54	7	13	41.21	39.33	1.88	39.33	0.55	39.88
Mount Pleasant, N. Y.	1831-1844	13	5	38	36.19	34.68	1.51	34.68	0.63	35.31
Gloversville, N. Y.	1893-1905	13	3	23	44.31	43.32	0.99	43.32	0.23	43.55
Binghamton, N. Y.	1891-1905	15	2	13	34.00	33.50	0.50	33.50	0.07	33.57
Montgomery, N. Y.	1828-1842	15	5	33	34.93	32.77	2.16	32.77	0.82	33.59
Liberty, N. Y.	1851-1904	53	7	13	47.11	44.57	2.54	44.57	1.37	45.94
Greenwich, N. Y.	1898-1905	7	0	0	37.72	37.72	0.00	37.72	0.00	37.72
Lake Hill, N. Y.	1903-1905	3	1	33	49.04	48.62	0.42	48.62	0.14	48.76
Oneonta, N. Y.	1895-1905	10	2	20	39.40	38.54	0.86	38.54	0.19	38.73
Catskill, N. Y.	1897-1900	3	0	0	38.46	38.46	0.00	38.46	0.00	38.46
Middleburg, N. Y.	1889-1891	3	0	0	38.12	38.12	0.00	38.12	0.00	38.12
Windham, N. Y.	1900-1905	6	3	50	40.74	37.70	3.04	37.70	1.52	39.22
South Hartford, N. Y.	1864-1878	15	5	33	41.13	38.13	3.00	38.13	1.26	39.39
Laurensburg, N. Y.	1826-1846	20	9	45	35.45	31.43	4.02	31.43	0.91	32.34
Glens Falls, N. Y.	1879-1905	26	6	23	37.65	36.80	0.85	36.80	0.31	37.11
South Kortright, N. Y.	1889-1905	16	4	25	39.79	39.38	0.41	39.38	0.06	39.44
West Berne, N. Y.	1903-1905	3	0	0	34.05	34.05	0.00	34.05	0.00	34.05
Red Hook, N. Y.	1902-1903	2	0	0	33.09	33.09	0.00	33.09	0.00	33.09
Fort Jervis, N. Y.	1890-1905	16	3	19	48.99	47.65	1.34	47.65	0.25	47.90
North Salem, N. Y.	1830-1850	20	10	50	41.34	39.91	1.43	39.91	0.64	40.55
Carvers Falls, N. Y.	1889-1905	16	6	38	35.42	35.42	0.00	35.42	0.00	35.42
New Lisbon, N. Y.	1891-1905	15	3	20	40.16	39.35	0.81	39.35	0.16	39.51
Delhi, N. Y.	1828-1852	24	1	4	40.05	37.93	2.12	37.93	0.70	38.63
Griffins Corners, N. Y.	1901-1905	5	1	20	43.94	42.43	1.51	42.43	0.30	42.73
Athens, N. Y.	1903-1905	3	0	0	38.61	38.61	0.00	38.61	0.00	38.61
Mohawk, N. Y.	1891-1905	15	6	40	50.97	47.43	3.54	47.43	1.77	49.20
Newburgh, N. Y.	1828-1867	40	10	25	36.08	34.01	2.07	34.01	1.04	35.05

In order to show that the isohyetal lines as drawn on the watersheds differ but very slightly from the most probable values of the rainfall at each of the stations, three diagrams, figs. 2, 3, and 4 are submitted.

Fig. 2 shows what may be called a vertical section north and south along the Hudson River, from New York to Troy. On this diagram are plotted the observed values of the rainfall and also the values as read from the isohyetal lines on the map. It will be noted that the greatest difference occurs at Catskill, where it amounts to 8 per cent. Fig. 3 may be called a vertical section east and west, approximately thru Binghamton, N. Y., on the west, and Amherst, Mass., on the east. The greatest difference between the observed rainfall and that from the isohyetal lines again occurs at Catskill, where the difference is again 8 per cent. In fig. 4, which is a section east and west thru Towanda, Pa., on the west and Hartford, Conn., on the east, the greatest difference is shown to be less than 3 per cent. Where the words "observed rainfalls" are used in these figures and in the foregoing description, it must be remembered that they are the observed rainfalls as modified in the manner hereinbefore described.

In order further to justify the isohyetal lines as drawn on the map submitted herewith, a tracing was made showing as points only the positions of those stations having records of fifteen years or more in length, and the isohyetal lines were drawn among them strictly as a problem in contours. The results so obtained differed in no essential particular from those obtained by drawing in the lines and giving consideration to all records, no matter what their length. As a test of the method this was a particularly severe one, and the close agreement was a matter of much gratification.

As indicating, in a general way, the correctness of the result for the most probable value of the mean rainfall on the Esopus watershed, the following table showing the average rainfall for the Esopus as given by the average of seven gages, and as deduced from the New York and Albany records, has been prepared. It covers a period of but six months, and can therefore be considered as having a minor value only. It is offered, however, for what it may be worth.

Station.	1905.			1906.			Total.
	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	
	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.
Albany	2.38	1.49	1.36	0.97	2.09	2.54	10.83
New York	2.67	1.67	3.67	2.98	2.57	5.58	19.14
Esopus, observed	4.17	2.30	3.74	2.73	2.35	4.78	20.07
Esopus—New York	2.67	1.67	3.67	2.98	2.57	5.58	19.14
Esopus—Albany	2.76	1.73	1.58	1.13	2.42	3.06	12.68

The theory has been advanced that the rainfall of these watersheds is large, owing to their comparatively great elevation. We believe that there is a zone of large rainfall which is the result of the influence of the mountains, but we believe also, on the contrary, that the watersheds under consideration, with the possible exception of Rondout, are outside of this zone. This is evidenced by all of the rainfall records now available, and would appear to be due to the cooling of the storm winds to below the dew-point before the mountain slopes are entirely reached, i. e., the mountain influences make themselves felt before the mountains themselves are reached by the storm winds. Precipitation is thus begun before the winds have traversed the high lands, and the zone of greatest rainfall lies around and not on or beyond the higher elevations.

We believe that the values of the probable mean annual rainfalls on the Catskill watersheds as derived in this discussion are the best that can be deduced from any data now available or in existence.

The values of the most probable mean annual rainfall on these watersheds having been determined and the actual most

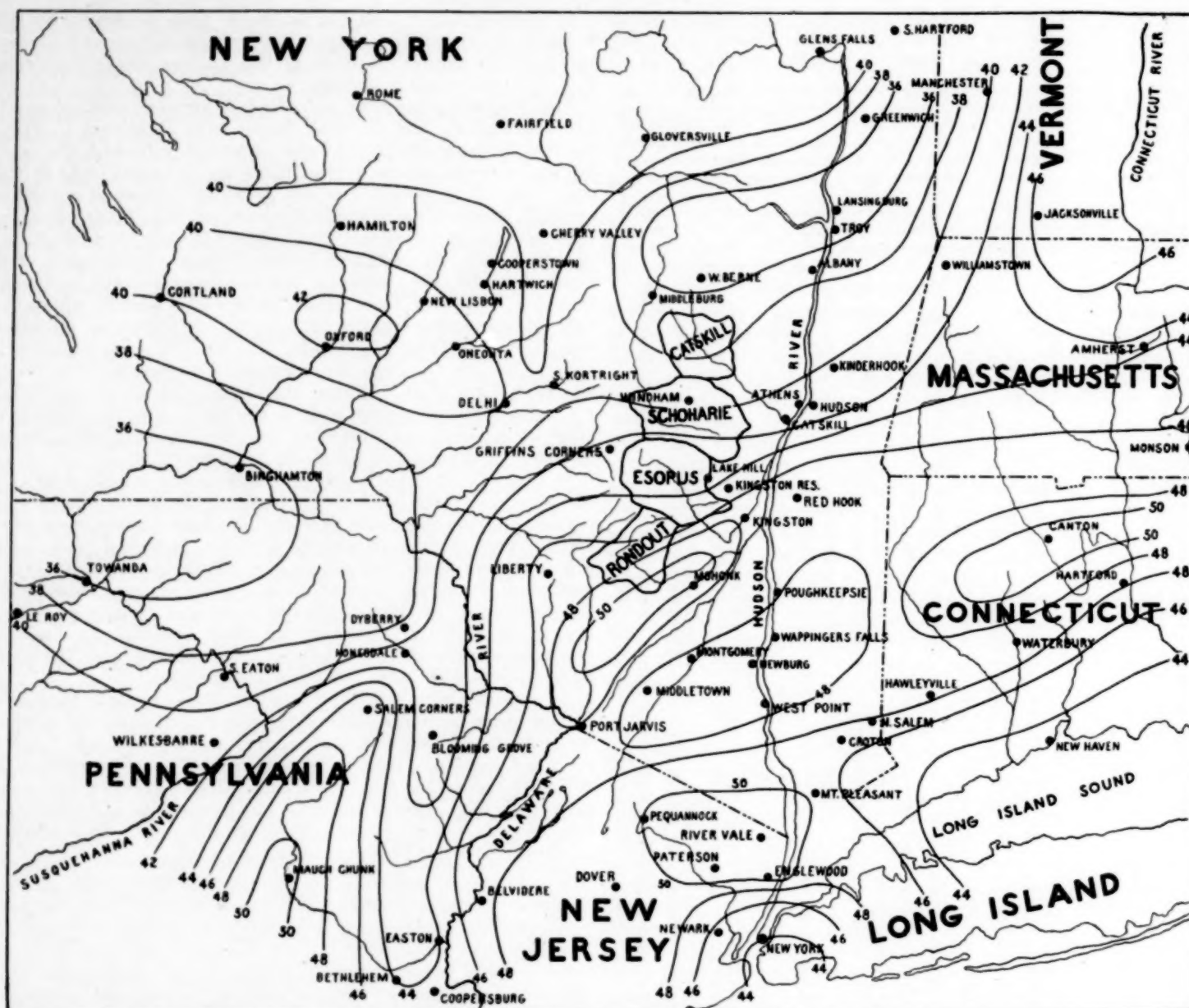


FIG. 1.—Map of the Catskill Mountain region and vicinity, showing by isohyetal lines the probable mean annual rainfall.

probable values of the rainfall at other points being known, it became easy to transfer their yearly rainfalls to each of the watersheds. Thus for the Esopus, where the rainfall is 44 inches, it can be said that the rainfall in any year was 44/38 of the rainfall during that year at Albany, or that it was 44/47 of that on the Croton watershed; 38 and 47 being the most probable values of the mean annual rainfall at Albany and on the Croton.

This method is probably of reasonable accuracy, but we desire to point out that it is not entirely satisfactory, inasmuch as it transfers the local characteristics of the rainfall at Albany or on the Croton to the locality being studied. We believe that each locality has its own characteristics, but in the absence of any direct observations the method followed is the best available.

#### RUN-OFF.

The run-off from a watershed is the water that appears in the stream which drains the watershed and becomes available for use. It is the difference between the rainfall and the evaporation, if in this latter term there be included all water required by the vegetation, and also that required and used by all other natural causes.

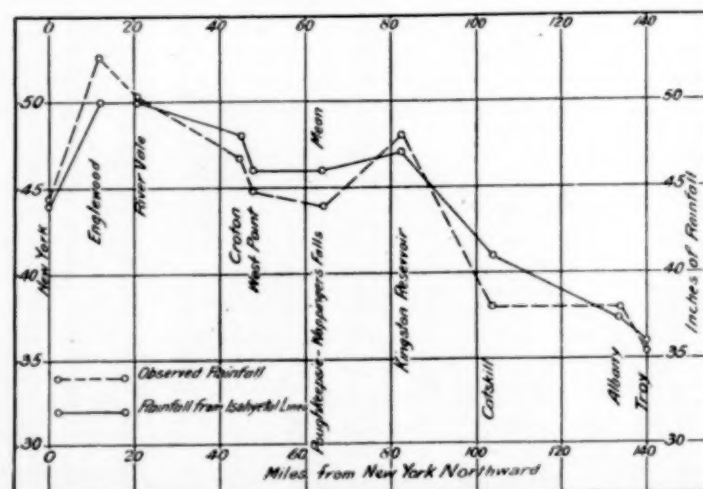


FIG. 2.—Rainfall values along a south-north line from New York to Troy, N. Y.

TABLE 2.—*Deduced mean annual dependable precipitation derived by the use of the contemporaneous precipitation in the vicinities of New York and Albany.*

Place.	Time of record.	Length of record.	Mean dependable precipitation.	Precipitation during same period in vicinity of—		Mean precipitation from—		Deducted mean annual dependable precipitation.
				New York.	Albany.	New York.	Albany.	
	Years.	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.
Vicinity of New York.	1836-1905	70	44.07	44.07		44.07		44.07
Vicinity of Albany.	1825-1904	80	36.34		36.34		36.34	36.34
Croton watershed.	1868-1904	37	46.73	44.98	36.70	45.55	36.46	45.91
Pequanook watershed.	1893-1905	13	47.71	45.00	33.98	46.73	51.18	48.95
Le Roy, Pa.	1889-1905	17	40.12	44.99	34.98	39.29	41.66	40.47
Dyberry, Pa.	1866-1898	25	59.00	44.77	37.28	38.42	38.01	38.22
Blooming Grove, Pa.	1866-1894	27	39.80	44.44	37.09	39.48	39.13	39.22
Towanda, Pa.	1896-1905	10	35.20	45.32	34.17	34.24	37.41	35.82
Easton, Pa.	1857-1905	26	43.71	46.09	35.60	41.91	44.55	43.28
Mauch Chunk, Pa.	1890-1905	14	48.74	44.30	34.40	47.41	51.52	49.46
South Eaton, Pa.	1890-1905	16	38.32	44.97	34.68	37.57	40.16	38.87
Salem Corners, Pa.	1870-1899	9	48.39	45.10	37.33	47.30	47.12	47.21
Bethlehem, Pa.	1878-1903	26	42.19	44.93	36.35	41.40	44.93	43.17
Coopersburg, Pa.	1890-1900	11	46.48	44.43	34.51	46.38	48.97	47.67
Wilkes-Barre, Pa.	1885-1905	17	38.84	44.78	34.41	38.13	41.01	39.57
Belvidere, N. J.	1892-1904	11	45.48	43.85	33.92	45.71	48.74	47.22
Dover, N. J.	1886-1905	20	47.72	45.78	35.67	45.97	48.65	47.51
Honesdale, Pa.	1882-1894	13	41.75	46.01	37.13	40.00	40.85	40.42
River Vale, N. J.	1893-1904	12	48.62	45.04	33.99	47.57	52.11	49.84
Kinderhook, N. Y.	1830-1846	17	35.17		35.52		36.00	36.00
New York, N. Y.	1836-1905	70	43.71	44.07		43.71		43.71
Newark, N. J.	1844-1904	61	44.62	44.07		44.62		44.62
West Point, N. Y.	1843-1899	48	43.78	44.29	36.36	43.60	43.78	43.69
Poughkeepsie, N. Y.	1829-1892	23	37.64		36.52		37.45	37.45
Poughkeepsie, N. Y.	1830-1899	24	36.16		35.79		37.71	37.71
Albany, N. Y.	1826-1904	79	37.31		36.34		37.31	37.31
Troy, N. Y.	1826-1886	59	35.18		36.34		35.18	35.18
Oxford, N. Y.	1829-1905	39	59.80		34.79		41.89	41.89
Hudson, N. Y.	1827-1855	19	36.20		37.21		35.49	35.49
Hartwick, N. Y.	1826-1850	14	36.63		37.52		35.56	35.56
Hamilton, N. Y.	1827-1895	19	33.26		36.80		32.93	32.93
Cooperstown, N. Y.	1854-1905	52	38.92	45.42	36.26	37.79	38.92	38.86
Granville, N. Y.	1835-1848	13	30.65		35.86		30.96	30.96
Fairfield, N. Y.	1828-1848	16	34.90		36.18		34.55	34.55
Cherry Valley, N. Y.	1827-1845	14	40.31		36.18		40.31	40.31
Englewood, N. J.	1896-1904	5	49.70	44.65	35.52	49.20	54.02	51.61
Rome, N. Y.	1890-1904	13	44.84	44.90	34.17	43.96	47.70	45.83
Canton, Conn.	1889-1904	16	48.53	45.02	34.98	47.58	50.55	49.07
Waterbury, Conn.	1889-1904	15	46.82	45.29	35.46	45.46	47.78	46.62
New Haven, Conn.	1887-1904	18	42.73	45.77	35.76	41.09	43.60	42.35
Hartford, Conn.	1888-1904	15	48.28	45.96	35.69	46.42	49.16	47.79
Amherst, Mass.	1887-1904	14	43.95	45.68	35.51	42.26	44.85	43.56
Wappingers Falls, N. Y.	1891-1905	15	46.60	44.63	33.86	46.14	50.11	48.13
Middletown, N. Y.	1891-1905	9	42.99	44.65	33.35	42.57	45.65	44.11
Jacksonville, Vt.	1889-1904	13	44.19	44.92	34.41	43.82	46.52	44.92
Cortland, N. Y.	1851-1905	24	39.33	47.12	33.93	36.76	42.29	39.53
Mount Pleasant, N. Y.	1831-1844	12	34.68		35.18		35.75	35.75
Gloversville, N. Y.	1893-1905	13	43.32	45.00	33.45	42.47	47.09	44.78
Binghamton, N. Y.	1891-1905	15	33.50	44.62	33.86	33.17	36.02	34.00
Montgomery, N. Y.	1828-1842	13	32.77		36.67		32.45	32.45
Liberty, N. Y.	1851-1904	13	44.57	44.96	34.21	43.70	47.41	45.56
Greenwich, N. Y.	1895-1905	7	46.51	46.51	34.60	43.88	48.96	46.42
Lake Hill, N. Y.	1906-1905	3	48.62	44.76	30.78	48.14	57.32	52.73
Paterson, N. J.	1892-1904	13	49.86	44.68	34.05	49.37	53.04	51.21
Oneonta and Bloomville, N. Y.	1835-1905	9	38.54	44.06	31.64	38.54	44.30	41.42
Catskill, N. Y.	1897-1900	3	38.46	41.26	36.16	38.46	38.46	38.46
Middleburg, N. Y.	1889-1891	3	38.12	46.50	39.02	35.96	35.63	35.80
Windham, N. Y.	1900-1905	6	37.70	45.62	33.03	36.23	41.43	38.84
South Hartford, N. Y.	1864-1878	12	38.13	46.96	27.59	35.97	37.02	36.50
Manchester, Vt.	1888-1904	6	43.33	47.39	35.92	40.12	43.77	41.95
Lansingburg, N. Y.	1826-1846	20	31.43		36.03		31.75	31.75
Glens Falls, N. Y.	1879-1905	26	36.30	44.46	35.20	35.94	37.42	36.68
South Kortright, N. Y.	1889-1905	14	39.38	45.04	34.89	38.61	41.45	40.03
West Berne, N. Y.	1903-1905	3	34.05	44.76	30.77	33.50	40.05	36.78
Red Hook, N. Y.	1902-1903	2	53.09	47.51	35.78	49.17	54.17	51.67
Port Jervis, N. Y.	1890-1905	16	47.65	44.91	34.20	46.72	50.69	48.71
Monson, Mass.	1890-1904	14	44.90	45.22	35.17	43.59	46.29	44.94
Hawleyville, Conn.	1899-1904	6	49.08	45.52	33.35	47.65	53.93	50.71
North Salem, N. Y.	1830-1859	22	39.91		36.33		39.91	37.55
Carvers Falls, N. Y.	1899-1903	6	35.42	45.20	31.65	34.39	42.31	40.64
New Lisbon, N. Y.	1891-1905	15	39.35	44.62	33.86	38.96	42.31	40.64
Delhi, N. Y.	1828-1852	3	37.93		35.21		39.10	39.10
Griffins Corners, N. Y.	1901-1905	5	42.43	45.94	33.52	40.80	46.12	43.46
Athens, N. Y.	1903-1905	3	38.61	44.76	30.78	37.85	45.42	41.64
Mohonk, N. Y.	1891-1905	12	47.43	44.81	34.20	46.50	50.46	48.48
Newburgh, N. Y.	1828-1867	20	33.54		36.20		33.54	33.54
Williamstown, Mass.	1855-1904	35	37.27	45.42	35.11	36.18	38.42	37.30
Kingston Reservoir No. 1, N. Y.	1900-1905	6	44.77	45.62	33.03	44.78	49.15	46.94

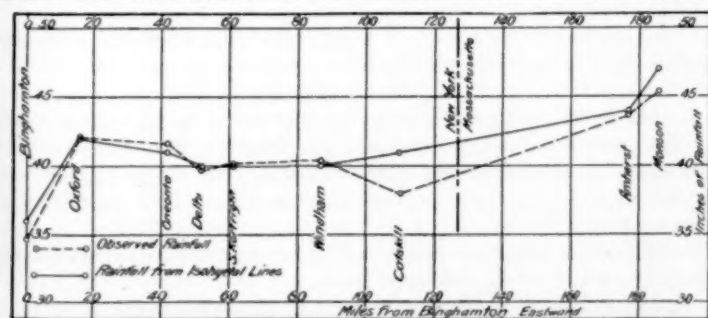


FIG. 3.—Rainfall values along a west-east line from Binghamton, N. Y., to Monson, Mass.

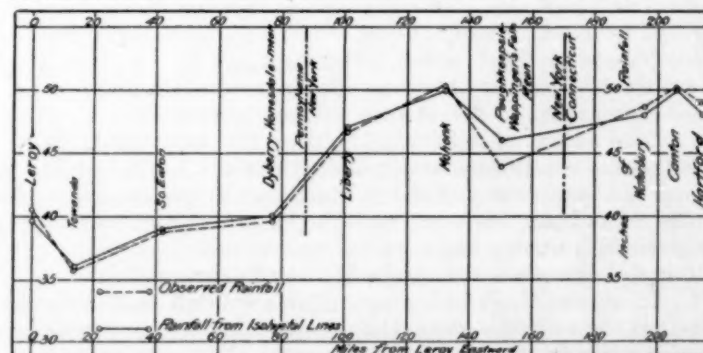


FIG. 4.—Rainfall values along a west-east line from Le Roy, Pa., to Hartford, Conn.

TABLE NO. 3.—Showing that the rainfall at any station within 100 miles of the Ashokan reservoir will, for 72 per cent of the time, vary from its mean by practically the same percentage as that at any other station also within the same distance

Stations.	Mean depend-able.	1827	1828	1829	1830	1831	1832	1833	1834	1835	1836	1837	1838	1839	1840	1841	1842
Albany .....	37.31	127	97	103	98	105	120	92	87	109	108	100	102	102	120	102	124
Hudson .....	36.20	110	104	92	123	125	105	84	95	.....	.....	.....	.....	.....	.....	.....	98
Kingston .....	37.64	.....	.....	103	107	117	102	114	95	90	98	90	99	90	87	98	90
New York .....	43.71	.....	.....	.....	.....	.....	.....	.....	.....	.....	63	107	96	98	68	96	78
Average .....	.....	118	100	99	102	115	116	104	89	98	90	99	99	97	92	99	98
		1843	1844	1845	1846	1847	1848	1849	1850	1851	1852	1853	1854	1855	1856	1857	1858
Albany .....	37.31	190	87	109	102	112	117	93	125	93	85	112	81	100	97	101	92
Hudson .....	36.20	110	90	72	71	105	92	78	.....	100	107	.....	137	.....	.....	.....	.....
Kingston .....	37.64	.....	.....	89	94	101	101	86	.....	.....	.....	.....	.....	.....	.....	.....	.....
New York .....	43.71	76	83	78	112	123	84	73	112	98	100	119	90	121	93	102	119
West Point .....	43.78	108	112	99	85	80	113	88	125	93	83	125	108	104	91	102	98
Liberty .....	44.57	.....	.....	.....	.....	.....	.....	.....	97	99	124	100	103	83	114	90	103
Cooperstown .....	38.92	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	98	118	76	134	116
Average .....	.....	106	93	89	93	104	101	84	121	94	93	117	95	114	88	111	103
		1864	1865	1866	1867	1868	1869	1870	1871	1872	1873	1874	1875	1876	1877	1878	1879
Albany .....	37.31	75	98	92	102	96	93	124	116	105	106	100	103	103	88	133	104
Hudson .....	36.20	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Kingston .....	37.64	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
New York .....	43.71	109	129	105	110	133	104	90	117	97	99	87	94	84	92	111	89
West Point .....	43.78	85	93	90	103	85	109	97	110	105	102	92	101	110	95	102	97
Liberty .....	44.57	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Cooperstown .....	38.92	77	91	83	83	96	118	85	93	95	106	94	97	96	89	100	78
Dyberry .....	39.00	.....	.....	.....	.....	.....	.....	.....	97	87	101	82	77	.....	.....	109	85
Croton .....	46.60	.....	.....	.....	.....	.....	.....	.....	105	87	94	91	82	87	98	120	101
Bethlehem .....	42.19	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	104	93
Average .....	.....	87	103	93	100	101	102	93	106	96	101	91	92	96	92	111	92
		1885	1886	1887	1888	1889	1890	1891	1892	1893	1894	1895	1896	1897	1898	1899	1900
Albany .....	37.31	82	92	107	120	106	106	103	94	95	94	80	75	110	104	78	82
Hudson .....	36.20	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Kingston .....	37.64	.....	.....	.....	.....	119	109	112	101	.....	.....	.....	.....	.....	.....	.....	.....
New York .....	43.71	96	107	107	121	108	109	95	87	121	101	82	87	89	103	96	95
West Point .....	43.78	.....	.....	.....	.....	.....	.....	87	96	112	92	107	105	102	118	102	.....
Liberty .....	44.57	.....	.....	.....	.....	.....	.....	92	.....	.....	.....	.....	.....	.....	.....	.....	.....
Cooperstown .....	38.92	86	85	92	98	99	100	105	111	115	97	95	101	119	118	97	106
Dyberry .....	39.00	99	97	117	129	.....	136	106	103	115	93	74	.....	130	.....	.....	.....
Croton .....	46.60	94	102	100	117	110	116	91	95	109	101	87	98	98	109	97	105
Bethlehem .....	42.19	85	105	102	100	115	121	104	85	95	88	78	105	100	105	93	81
Dover .....	47.72	.....	90	98	113	105	100	104	81	110	91	74	93	104	101	95	89
Amherst .....	43.95	.....	.....	114	124	101	111	99	83	96	73	92	94	.....	115	95	.....
Waterbury .....	46.82	.....	.....	.....	.....	98	110	92	86	109	93	97	.....	98	108	87	91
South Kortright .....	39.38	.....	.....	.....	.....	106	114	96	91	109	89	81	86	100	107	.....	121
Binghamton .....	33.50	.....	.....	.....	.....	.....	.....	.....	118	115	119	113	91	101	99	118	70
Mohonk .....	47.43	.....	.....	.....	.....	.....	.....	.....	108	108	98	93	.....	90	86	.....	100
Pequanook .....	47.71	.....	.....	.....	.....	.....	.....	.....	.....	.....	104	96	77	102	102	107	100
Windham .....	37.70	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	87
Griffins Corners .....	42.43	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	94	121
Lake Hill .....	48.62	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	119
Average .....	.....	90	97	106	115	107	112	100	95	108	95	79	95	101	111	92	90

In order to determine the run-off, then, it becomes necessary first to determine the evaporation, which is dependent in some measure on each of the following conditions:

- The rainfall.
- The extent of the watershed.
- The extent of water surface on the watershed.
- The barometric pressure.
- The mean daily atmospheric temperature.
- The mean annual atmospheric temperature.
- The wind velocity.
- The inclination of the watershed.
- The geological character of the watershed.
- The extent of forest area on the watershed.
- The extent of cultivated land on the watershed.

All these conditions, and possibly some others, operate to render the problem a difficult one, and as yet no successful attempt has been made to devise a formula which will apply to more than one or two certain watersheds.

The following are the general laws of evaporation:

- All other things being equal, for a rainfall uniformly distributed thruout the year, the evaporation will increase proportionally with the rainfall.
- All other things being equal, a heavy winter and a light

summer rainfall will together show a small annual evaporation, and conversely.

3. All other things being equal, the greater the watershed the greater will be the evaporation.

4. All other things being equal, the greater the area of water surface on the watershed the greater will be the evaporation.

5. All other things being equal, the evaporation varies nearly inversely as the atmospheric pressure, or, it varies also nearly directly as the altitude of the watershed.

6. All other things being equal, the rate of evaporation is nearly proportional to the difference of the temperatures indicated by the wet-bulb and the dry-bulb thermometers.

7. All other things being equal, the capacity of atmospheric air for moisture is approximately doubled for each 20° F. increase in atmospheric temperature; the evaporation will therefore be in some measure increased by an increase in temperature.

8. All other things being equal, the evaporation varies nearly directly as the wind velocity.

9. All other things being equal, the evaporation from a watershed will vary approximately inversely as the square root of the sine of the angle of its average inclination to the horizon.

10. All other things being equal, the evaporation from a watershed will vary nearly as the extent of the surface it exposes. The extent of the surface it exposes is nearly proportional to its area divided by the cosine of the angle of its average inclination.

11. All other things being equal, the evaporation will vary nearly inversely as the porosity of the materials with which the watershed is covered.

12. All other things being equal, the evaporation will vary approximately with the extent of cultivated land on the watershed.

13. All other things being equal, the evaporation will vary approximately inversely with the extent of forest area on the watershed.

Vermeule in his report of 1894 to the geological survey of New Jersey made an extended study of the subject, and deduced an expression for the evaporation in which it was made to depend on the rainfall and on the mean annual atmospheric temperature of the watershed. This formula has been severely criticized by Rafter in his paper on "The relation of rainfall to runoff", U. S. Geological Survey Water Supply and Irrigation Paper No. 80, but the ground of the criticism, in view of the many causes which act to modify evaporation, appears to us to have no foundation.

Vermeule's formula is as follows:

$$\begin{aligned} E &= \text{yearly evaporation.} \\ R &= \text{yearly rainfall.} \\ T &= \text{mean annual temperature.} \\ F &= (0.05 T - 1.48) = \text{factor} = 1.00 \text{ for } 49.7^\circ \text{ F.} \\ E &= F(15.50 + 0.16 R). \end{aligned}$$

In monthly form this formula becomes

$$\begin{aligned} e &= \text{monthly evaporation.} \\ r &= \text{monthly rainfall.} \\ F &= \text{factor as heretofore.} \end{aligned}$$

January,	$e = F(0.27 + 0.10 r)$
February,	$e = F(0.30 + 0.10 r)$
March,	$e = F(0.48 + 0.10 r)$
April,	$e = F(0.87 + 0.10 r)$
May,	$e = F(1.87 + 0.20 r)$
June,	$e = F(2.50 + 0.25 r)$
July,	$e = F(3.00 + 0.30 r)$
August,	$e = F(2.62 + 0.25 r)$
September,	$e = F(1.63 + 0.20 r)$
October,	$e = F(0.88 + 0.12 r)$
November,	$e = F(0.66 + 0.10 r)$
December,	$e = F(0.42 + 0.10 r)$

$$E = F(15.50 + 0.16 R).$$

While we do not agree with Mr. Vermeule in the manner of the determination of the factor to be used for any watershed, we do think that the shape of his formula, when put into the monthly form he proposes, could not easily be improved upon. The most striking feature of this formula is that it takes account of the effect on the evaporation of unequal distribution of rainfall thruout the year.

Mr. Vermeule in his formula made this factor dependent entirely on the mean annual temperature, on the assumption that, as the capacity of atmospheric air for moisture is approximately doubled for each  $20^\circ \text{ F.}$  increase in atmospheric temperature, therefore the evaporation would be doubled for each such increase in temperature.

We do not believe that such is the case, and in support of this belief submit fig. 5, on which is plotted the percentage of rainfall evaporated for each of Rafter's three seasons as given in his paper heretofore referred to, for the Croton, Pequannock, and Sudbury watersheds. The temperatures on which these percentages were plotted were obtained from the U. S. Weather Bureau publications.

The remarkable parallelism of these lines indicates primarily the existence of a well-defined law, and secondarily, that the observations have been well made. The law defined by this diagram is that for each degree increase in temperature the

rainfall evaporated will be increased by very nearly 2 per cent. But it at once becomes apparent that the percentage increase in total evaporation will vary with the temperature, and we have plotted a curve as fig. 6 to define this variation.

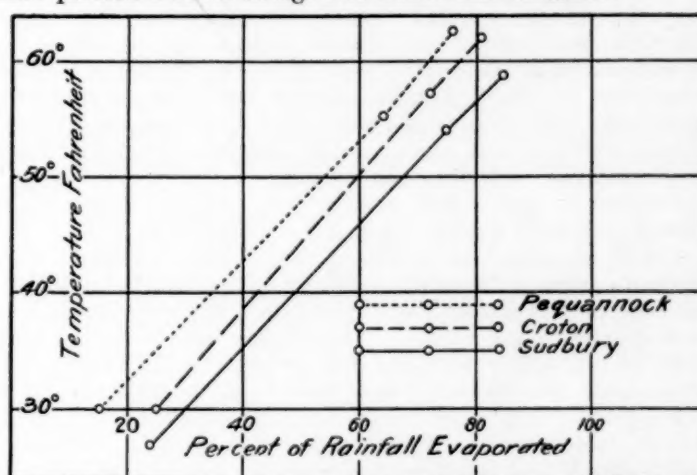


FIG. 5.—Percentage of rainfall evaporated at different temperatures from the Croton, Pequannock, and Sudbury watersheds.

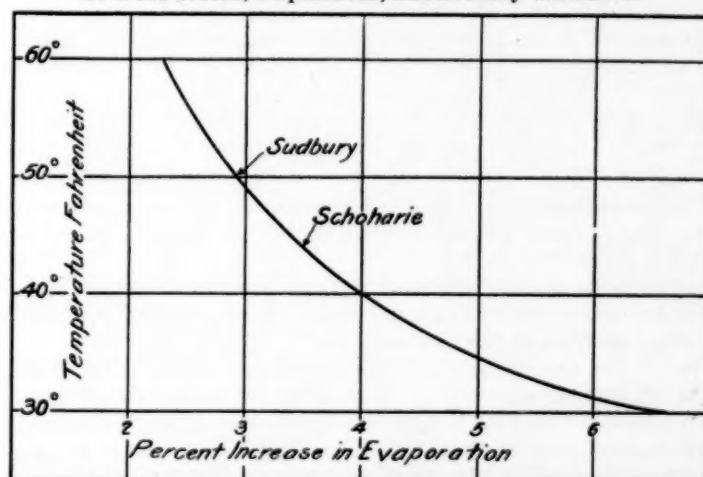


FIG. 6.—Variation of percentage increase of evaporation with change of temperature.

The mean annual temperature on the Sudbury is  $49^\circ \text{ F.}$  and on the coldest of the Catskill watersheds,  $44^\circ \text{ F.}$  In fig. 6 the increase in total evaporation between these limits averages 3.2 per cent, and this is the value that we believe to be correct for these studies, rather than 5 per cent as proposed by Vermeule.

Taking up now, in order, the general laws of evaporation, we see that laws 1 and 2 are fully provided for by the form of the expression we have adopted. Law 3 does not seem susceptible of adaptation to a numerical expression. Law 4 is easily provided for outside the formula by increasing the evaporation by the difference due to any increase in water surface.

Law 5 can be adapted directly by assuming some watershed as a standard and stating that the evaporation from any other watershed will be inversely as the atmospheric pressure upon it.

Practically no data are at hand concerning law 6, but it is a well-known fact that the air on the higher altitudes averages drier than on low lands, and we have therefore assumed that the difference in evaporation due to this cause (the dryness of the air) will be one-fourth that due to the difference occasioned by difference in barometric pressure and in the same direction.

Law 7 has already been fully discussed and the results stated.

On account of the absence of any knowledge of wind velocities, we are unable to apply the fact stated in law 8. It would

seem, however, that any difference due to this cause would be slight.

Law 9 is here proposed by us as being an approximation to the reasonable belief that steep watersheds will yield a greater proportion of the rainfall than will comparatively flat ones. This statement was put into the above form on account of the not unreasonable analogy between the flow of water in a channel and the flow both over the ground and in the creeks of a watershed. The steeper the watershed the more rapidly will the rain water run off, and therefore less time will be afforded the evaporation to reduce the volume.

In order to apply this principle, it becomes necessary to define the words "average inclination of the watershed", and it seemed to us proper to assume that if the watershed were square its average inclination would be the difference in vertical height between its highest and lowest points divided by the diagonal of the square. Table 4 has been prepared with a view to indicating the difference in slope of the Croton, the Pequannock, the Sudbury, and the Esopus watersheds. The square root of the sine of each of their average inclinations has been determined. The average inclinations of the Croton and Sudbury are practically the same, and the inclination of the Esopus is twice as great as either.

TABLE 4.—Mean slope of four watersheds.

Watershed.	Total dip.	Length of diagonal.	Mean slope per mile.	Angle.	Sin.	$\sqrt{\sin}$ .
	<i>Feet.</i>	<i>Miles.</i>	<i>Feet.</i>	<i>° ' "</i>		
Croton.....	1,100	26.38	83	0 54	.0156	.125
Sudbury.....	550	12.40	80	0 55	.0160	.126
Pequannock....	900	11.00	164	1 45	.0305	.174
Esopus.....	3,800	22.47	339	3 41	.0640	.253

As indicating the general correctness of this result, we quote from the report of the Commission on Additional Water Supply, page 234:

"The table shows that the Esopus yielded from the floods after the great drought a proportion of the rainfall just twice as great as that of the Croton".

While the method is therefore applicable to the heavy floods, it is of course entirely inapplicable to moderate rainfalls. Now one and one-half inches is a reasonably heavy fall of rain, and in each year in these latitudes there occur on an average about eight such rains, which aggregate about eleven inches, or about 25 per cent of the total yearly rainfall. We feel, therefore, that this principle is applicable to the extent of 25 per cent of its full value for all cases.

Law 10 is of little value, and has been stated only for the sake of completeness.

Law 11 treats of the character of the soil. A watershed covered with loose gravel and sand will usually show a greater yield than one with a clay cover, as the rainfall sinks into the more porous material, and is in this manner largely protected against evaporation until it again finds its way into the streams thru springs or underground channels. All of the Catskill watersheds, with the possible exception of the Catskill, are fairly well covered with a loose rock covering on the mountain slopes, while the lower reaches of the valleys are filled with deposits of gravel. The intermediate lands are covered with an iceberg clay and do not afford much opportunity for water to penetrate into them. It does not appear to us that these watersheds are remarkable either for the presence or for the absence of opportunity for water to protect itself against evaporation by percolating into and thru the subsoil. In any event, it does not appear likely that this law could ever be numerically applied to a watershed.

In order to bring these laws down to actual figures, it is now necessary that we have the characteristics of the watersheds before us, and for purposes of comparison we have added also the same data for the Croton, Sudbury, and Pequannock watersheds.

Watersheds.	Area.	Average altitude.	Average barometer.	Mean temperature.	$\sqrt{\sin}$ average slope.	Rainfall.
	<i>sq. m.</i>	<i>Feet.</i>	<i>Inches.</i>	<i>° F.</i>		<i>Inches.</i>
Esopus.....	255	1700	28.1	45	.253	44
Schoharie.....	228	2000	27.8	44	.160	41
Rondout.....	131	1600	28.2	47	.211	48
Catskill.....	163	1500	28.3	46	.153	38
Pequannock....	62	1100	28.7	48	.174	50
Croton.....	339	600	29.3	49	.125	47
Sudbury.....	78	350	29.6	49	.126	46

Now, under law 5, if we assume the Croton as a standard, we find that the evaporation on each of the other watersheds will be as follows:

Esopus..... 4.5 per cent greater than Croton.  
Schoharie.... 6.5 per cent greater than Croton.  
Rondout..... 4.5 per cent greater than Croton.  
Catskill..... 3.5 per cent greater than Croton.  
Pequannock . 2.3 per cent greater than Croton.  
Sudbury..... 0.6 per cent less than Croton.

Under law 6 and our assumption, we find that the evaporation will be as follows:

Esopus..... 1.1 per cent greater than Croton.  
Schoharie.... 1.6 per cent greater than Croton.  
Rondout..... 1.1 per cent greater than Croton.  
Catskill..... 0.9 per cent greater than Croton.  
Pequannock . 0.8 per cent greater than Croton.  
Sudbury..... 0.1 per cent less than Croton.

And under law 7 and our discussion of it, we see that the evaporation will be as follows:

Esopus..... 12.8 per cent less than Croton.  
Schoharie.... 16.0 per cent less than Croton.  
Rondout..... 6.4 per cent less than Croton.  
Catskill..... 9.6 per cent less than Croton.  
Pequannock . 3.2 per cent less than Croton.  
Sudbury..... 0.0 per cent less than Croton.

Finally, under law 10 and our assumptions thereunder, we find that the evaporation is—

Esopus..... 25.5 per cent less than on the Croton.  
Schoharie.... 7.0 per cent less than on the Croton.  
Rondout..... 17.2 per cent less than on the Croton.  
Catskill..... 5.6 per cent less than on the Croton.  
Pequannock . 9.8 per cent less than on the Croton.  
Sudbury..... 0.0 per cent less than on the Croton.

Now, summing up these differences, we have the following:

Watersheds.	Barometer.	Dryness.	Temperature.	Inclination.	Total.
Esopus.....	+4.5	+1.1	-12.8	-25.5	-32.7
Schoharie.....	+6.5	+1.6	-16.0	-7.0	-14.9
Rondout.....	+4.5	+1.1	-6.4	-17.2	-18.0
Catskill.....	+3.5	+0.9	-9.6	-5.6	-10.8
Pequannock ..	+2.3	+0.8	-3.2	-9.8	-9.9
Sudbury.....	-0.6	-0.1	0.0	0.0	-0.7

This indicates that these watersheds will yield of the rain which falls upon them more than will the Croton, by the following averages:

Esopus..... 33 per cent.  
Schoharie.... 15 per cent.  
Rondout..... 18 per cent.  
Catskill..... 11 per cent.  
Pequannock . 10 per cent.  
Sudbury..... 0.7 per cent.

Now in the formula we have adopted the evaporation is expressed in terms of the rainfall, and its factor for the Croton is 100 per cent. The factors which the preceding discussion leads us to use for these watersheds are, then, the difference between 100 per cent and the greater percentage of yield of each as heretofore shown.

The factors derived and used are the following:

Esopus..... 0.67  
Schoharie.... 0.85  
Rondout..... 0.82  
Catskill..... 0.89  
Pequannock . 0.90  
Sudbury..... 0.993

That these factors so deduced "fit" the Pequannock, the Croton, and the Sudbury with reasonable accuracy is indicated by the following:

Watershed.	Record.	Observed run-off.	Computed run-off.	Factor.
		<i>Inches.</i>	<i>Inches.</i>	
Sudbury.....	{Average, } {1873-1903}	22.85	22.03	0.993
Pequannock.....	{11 years, } {1883-1903}	331.36	332.76	0.90
Croton.....	{Average, } {1868-1899}	22.93	24.82	1.00

Table 5 is also submitted as showing in detail the agreement of the formula with the observed values of the run-off on the Pequannock.

TABLE 5.—Observed and computed run-offs of the Pequannock River by Vermeule's formula, with a temperature factor of 0.90.

Year.	Rainfall.	Run-off.		Per cent of run-off.	
		Observed.	Computed.	Observed.	Computed.
1893.....	49.73	32.79	28.57	66	57
1894.....	44.62	28.59	24.24	64	54
1895.....	36.67	18.97	17.35	51	47
1896.....	51.89	30.75	30.05	59	58
1897.....	57.97	29.57	33.98	51	59
1898.....	51.39	28.98	30.17	56	59
1899.....	47.94	26.88	26.93	56	56
1900.....	42.00	21.50	22.16	51	53
1901.....	64.69	31.94	40.47	49	63
1902.....	60.44	35.73	37.73	59	62
1903.....	64.79	46.06	41.11	71	63
1904.....	45.24	.....	24.54	.....	54
1905.....	43.53	.....	23.21	.....	53
Totals to end of 1903.....		331.36	332.76	58	58

Now, applying our formula to each of these watersheds, we find that on an average we may expect:

Watershed.	Rainfall.	Evaporation.	Run-off.	Per cent of run-off.
	<i>Inches.</i>			
Esopus.....	44	15.10	28.90	65
Schoharie.....	41	18.75	22.25	54
Rondout.....	48	19.00	28.00	58
Catskill.....	38	19.20	18.80	49
Pequannock.....	50	21.15	28.85	57
Croton.....	47	23.02	23.98	51
Sudbury.....	46	24.46	21.54	47

Diagrams submitted with the report of Mr. J. Waldo Smith, Chief Engineer to the Aqueduct Commissioners, dated January 30, 1905, indicate very clearly that the Croton, with a storage of 250,000,000 gallons per square mile, will not safely sustain a draft of more than 325,000,000 gallons per day.

The watershed of the Croton River, above the New Croton Dam, is 360 square miles, and the safe yield per square mile is, therefore, 900,000 gallons per day.

Now it is safe to assume that in extremely dry periods the run-off will be 50 per cent less than in an average period, and on this basis, all other conditions being the same, the watersheds being studied will yield the following percentages of the Croton normal yield:

Esopus.....	12.8 per cent less than Croton.
Schoharie.....	25.6 per cent less than Croton.
Rondout.....	1.0 per cent greater than Croton.
Catskill.....	38.2 per cent less than Croton.
Pequannock.....	3.2 per cent greater than Croton.
Sudbury.....	4.2 per cent less than Croton.

And we have seen that owing to the natural features of these watersheds they will yield, for the same rainfall as on the Croton, the following percentages:

Esopus.....	32.7 per cent more than Croton.
Schoharie.....	14.9 per cent more than Croton.
Rondout.....	18.0 per cent more than Croton.
Catskill.....	10.8 per cent more than Croton.
Pequannock.....	9.9 per cent more than Croton.
Sudbury.....	0.7 per cent more than Croton.

Now, combining these, we deduce finally that these watersheds may be expected to have a safe yield, compared to the Croton safe yield, as follows:

Esopus.....	19.9 per cent more than Croton.
Schoharie.....	10.7 per cent less than Croton.
Rondout.....	19.0 per cent more than Croton.
Catskill.....	27.4 per cent less than Croton.
Pequannock.....	13.2 per cent more than Croton.
Sudbury.....	4.9 per cent less than Croton.

And, therefore, on a storage of 250,000,000 gallons per square mile of watershed may be expected to have a safe yield as follows:

Esopus.....	1,080,000 gallons per day per square mile.
Schoharie.....	804,000 gallons per day per square mile.
Rondout.....	1,070,000 gallons per day per square mile.
Catskill.....	653,000 gallons per day per square mile.
Pequannock.....	1,010,000 gallons per day per square mile.
Sudbury.....	856,000 gallons per day per square mile.

In connection with this report certain depletion diagrams [not reproduced here] were prepared.

The first diagram shows the depletion of the proposed Ashokan Reservoir when fed by the Esopus Creek, on the basis of the Albany rainfall records. It indicates that a draft of 240,000,000 gallons per day from the 255 square miles of tributary watershed could not well be exceeded without drawing down the reservoir to a considerable extent and for long periods. The maximum depletion shown is 40,000,000,000 gallons, or 160,000,000 gallons per square mile of watershed.

In the preparation of this diagram, as well as of all others, the formula as heretofore derived was employed, except that a factor of 0.75 was used instead of those deduced. This was done for the reason that it is not, at present at least, proposed to use the Ashokan Reservoir fed by the Esopus alone, but by the Esopus and Schoharie in combination.

The factor for the Schoharie is 0.85, and that for the Esopus 0.67. In proportion to the area of these watersheds, the combined factor would be

$$\begin{aligned} 0.85 \times 228 &= 193.80 \\ 0.67 \times 255 &= 170.85 \end{aligned}$$

$$483 \div 364.65 (= 0.75)$$

Increase in evaporation due to reservoir water surface was provided for in the computations on which these depletion diagrams are based by assuming that the water surface on the Schoharie would be 1000 acres and on the Esopus 10,000 acres, and the corresponding corrections were made.

The second diagram shows the conditions which would obtain in the Ashokan Reservoir when collecting from the Esopus and Schoharie watersheds under a draft of 410,000,000 gallons daily and on the basis of the Albany rainfall records. This diagram indicates a maximum depletion of 63,000,000,000 gallons, or a minimum necessary storage of 130,000,000 gallons per square mile of watershed area. It also shows that the combined safe draft from these two watersheds should not exceed 425,000,000 gallons per day, or 880,000 gallons per square mile per day.

In the preparation of all the diagrams for the Schoharie, it has been assumed that the construction will be sufficient to divert all run-off up to and including that due to 7 inches of rain per month. For greater run-off than this but 80 per cent has been counted as becoming available.

The third diagram shows the conditions which would exist in the Ashokan Reservoir when fed by the Esopus and Schoharie under a draft of 410,000,000 gallons daily, but on the basis of the Croton rainfall records. The maximum depletion indicated under these conditions is 48,000,000,000 gallons.

The fourth and fifth diagrams show the conditions which would exist in the Ashokan Reservoir when fed by the Esopus and the Schoharie when under a draft of 410,000,000 gallons daily, and on the basis of the New York rainfall records.

The maximum depletion indicated under these conditions is 60,000,000,000 gallons.

Actual gagings of the four Catskill streams under consideration have been made by the United States Geological Survey more or less continually since 1901. The results of these gagings are set forth in the various water supply and irrigation papers published by the survey. Unfortunately, no rainfall observations were made contemporaneously with these gagings. A careful examination of practically all of the gagings made by the Geological Survey in New York, New Jersey, Pennsylvania, and New England since 1902 has caused us to use them as a general guide only.

#### CONCLUSIONS.

Our studies, therefore, lead us to the belief that the most probable mean annual rainfalls on the Catskill watersheds are as follows: Esopus, 44 inches; Schoharie, 41 inches; Rondout, 48 inches; Catskill, 38 inches.

#### VARIATION OF PRECIPITATION IN THE ADIRONDACK REGION.

By ALFRED J. HENRY, Professor of Meteorology. Dated April 17, 1907.

Mr. R. E. Horton, C. E., has worked out very clearly the relative distribution of precipitation in the Adirondack region for the five years, 1901-1905. The chart which accompanies Mr. Horton's article<sup>1</sup> shows a region of maximum precipitation (55 inches and upward) on the southwestern slope of the Adirondacks, particularly on the foothills in Lewis, Oneida, and Herkimer counties.

The writer was recently engaged on a study of the average annual precipitation over the watershed of Lake Ontario, which includes a portion of the area considered by Mr. Horton. The epoch used in this work was 1871-1906, altho the record at a number of the observing stations covered a much longer time. It is possible, therefore, to compare the mean values for the lustrum 1901-1905 with those of the much longer epoch, 1871-1906. Accordingly there will be found in the table below a statement showing the average annual precipitation for a few stations in the Adirondack region and contiguous territory for both the long and the short periods.

Comparative averages of precipitation.

Stations.	Length of record.	Whole period, 1871-1906.	Five years, 1901-05.	Departure.
		Years.	Inches.	Inches.
Oswego .....	54	37.4	40.0	+2.6
Lowville .....	40	36.3	44.3	+8.0
Utica.....	40	41.7	50.7	+9.0
Cooperstown.....	53	39.9	45.3	+5.4
Keene Valley .....	15	35.6	40.7	+5.1

It is clearly apparent from the above table that the lustrum 1901-1905 was one of heavy precipitation in the Adirondacks; the greatest departure, about 22 per cent of the mean annual fall, occurred near the center of the region of maximum precipitation hereinbefore mentioned. The writer has found elsewhere<sup>2</sup> that the extreme variation in the interior of this continent for a 10-year period is as high as 20 per cent. The variation for a 5-year period in this country has not been determined; in Germany, however, Dr. G. Hellmann<sup>3</sup> has found that the average maximum variation of a 5-year period for 14 stations in North Germany is 116 per cent, and for a 10-year period 109 per cent. The maximum variation for a single station for a 5-year period was 128 per cent, or 6 per cent greater than for the two stations in the Adirondack region, but the majority of the German stations showed a smaller variation. What little work has been done on this subject in the United States tends to show that the variation of the precipitation, especially in the interior, is greater than in England or Germany.

<sup>1</sup> Monthly Weather Review, January, 1907, Vol. XXXV, pp. 8-11.

<sup>2</sup> Weather Bureau Bulletin D, p. 9.

<sup>3</sup> Die Niederschläge in den norddeutschen Stromgebieten.

In conclusion it is proper to call attention to the fact that the chart of rainfall distribution compiled by Mr. Horton probably represents very closely the maximum amount of rain that may be expected for a 5-year period in the region under consideration. Readers of the Review should be careful, however, not to be misled by supposing that the chart purports to give the average or normal values for the Adirondack region, such as would result from a century of observations.

#### THE TEMPERATURE IN THE FRONT AND IN THE REAR OF ANTICYCLONES, UP TO AN ALTITUDE OF 12 KILOMETERS, COMPARED WITH THE TEMPERATURE IN THE CENTRAL AREA.

By HENRY HELM CLAYTON. Dated Blue Hill Observatory, Hyde Park, Mass., March 5, 1907.

Within the two years between the summer of 1904 and that of 1906, a series of observations with *ballons-sondes* were obtained at St. Louis, Mo., under the direction of Prof. A. Lawrence Rotch, by Mr. S. P. Fergusson and myself. These small balloons carried light instruments recording temperature and pressure, and occasionally reached heights of 17 kilometers or about 11 miles. These are the only data of this kind gathered in America up to the present time, and are of much interest and value in their bearing on the problems of the upper air. One of the problems of great interest is that of the distribution of temperature in cyclones and anticyclones. In a discussion of these observations published by me in the *Beiträge zur Physik der freien Atmosphäre*, Band II, Heft 2, 1906, the lowest temperatures (at the earth's surface) in the anticyclones were found in the central and southeastern portions, but this distribution was so changed at the height of 8 kilometers that the lowest temperature was found in the northern quadrant of the anticyclone. The reverse of this statement is true in regard to the cyclone in which the highest temperature was found in the eastern quadrant at the ground, but in the northern quadrant at the height of 8 kilometers. This matter is one of importance in studying the mechanism of these meteors and I give in the accompanying Table 1 some of the results in the individual cases where anticyclones past centrally over the region surrounding St. Louis. In this table the temperature at any height on the day in which the maximum pressure occurred at St. Louis is taken as the standard for that height and the departures from this of the temperatures at the same heights for the day preceding and the day following are given in so far as the observations permit. In each case the observations were obtained in the evening within an hour or two of 7 p. m. The tracks of the centers of maximum pressure are given on an accompanying chart, fig. 1. On this chart a circle of 300 miles radius (about 500 kilometers) is drawn around St. Louis, and it may be seen that all the given dates of maximum pressure at St. Louis are found within this area, while the dates of the preceding and following days are found outside the circle. In every case, except that of July 24 and 25, 1905, the general direction of motion was from northwest to southeast, so that observations on the day preceding were in the southeastern half of the anticyclone and on the day following in the northwestern half. The amounts in the table showing how much the temperatures in the front and in the rear of the anticyclone differed from those in the central area are plotted graphically in the accompanying diagram, fig. 2, which shows that in general it is colder in front of the anticyclone than in the central area, up to about 8 kilometers, above which altitude it becomes warmer. Of the two cases where the temperature in the rear was compared with that in the central area, in one case, January 26, 1905, it was warmer in the rear up to about 6 kilometers, and in the other case, May 10, 1906, it was warmer in the rear up to about 10 kilometers. Above these heights the rear was colder than the central area. The most instructive case is that of May 8 to

TABLE 1.—Temperatures at successive altitudes within anticyclones; (a) temperatures on the day of maximum pressure at St. Louis, Mo.; (b) the departures from these temperatures for the preceding day; and (c) the departures for the following day.

Number.	Date.	Pressure at 7 p. m.	Temperatures at altitudes above the earth's surface.											
			0 km.	1 km.	2 km.	3 km.	4 km.	5 km.	6 km.	7 km.	8 km.	9 km.	10 km.	11 km.
I—(a).....	1904. November 26.....	mm. 772.7	° C. 5.3	° C.	° C.	° C.	° C.	° C.	° C.	° C.	° C.	° C.	° C.	° C.
I—(b).....	November 25.....	770.4	+ 0.8			— 2.9	— 8.9	— 17.3	— 24.7	— 31.8	— 39.7	— 47.3	— 52.8	— 52.8
I—(c).....								— 5.3	— 4.7	— 4.5	— 1.7	+ 0.8	+ 5.5	
II—(a).....	1905. January 23.....	784.6	— 11.1	— 12.7	— 17.9	— 18.7	— 22.5	— 29.8	— 32.3	— 40.6	— 50.1	— 54.8	— 54.0	
II—(b).....	January 24.....													
II—(c).....	January 26.....	776.2	+ 7.5	+ 6.0	+ 10.1	+ 8.1	+ 5.9	+ 4.8	— 2.6	— 5.1	— 6.7			
III—(a).....	1905. July 24-25.....	765.2	24.4	17.5	9.1	6.9	2.3	— 2.7	— 8.1	— 16.0	— 24.1	— 32.8	— 42.5	
III—(b).....	July 23.....	763.0	+ 0.6	— 0.3	+ 1.2	— 2.6	— 1.0	— 0.6	— 2.2	— 2.8	— 1.7	+ 0.2		
III—(c).....	July 26.....													
IV—(a).....	1906. May 9.....	769.0	15.0	10.5	1.2	— 6.8	— 10.5	— 14.6	— 21.1	— 29.3	— 39.1	— 49.3	— 53.2	— 53.2
IV—(b).....	May 8.....	769.8	— 4.8	— 8.1	— 6.3	— 3.2	— 7.1	— 6.0	— 2.0	— 0.7	— 0.3	+ 2.9	+ 6.7	+ 6.3*
IV—(c).....	May 10.....	765.3	+ 5.0	+ 3.8	+ 6.8	+ 9.3	+ 4.7	+ 1.0	+ 2.3	+ 3.0	+ 3.7	+ 7.1	+ 1.8	— 5.8

\* Extrapolated; the temperature difference at 10.5 kilometers is +6.1°.



FIG. 1.—Tracks of centers of anticyclones passing near St. Louis at times of flights of balloons-sondes from that city.

10, when observations were obtained on three successive days, namely, when St. Louis was respectively in the front of the central area, within the central area, and in the rear of the

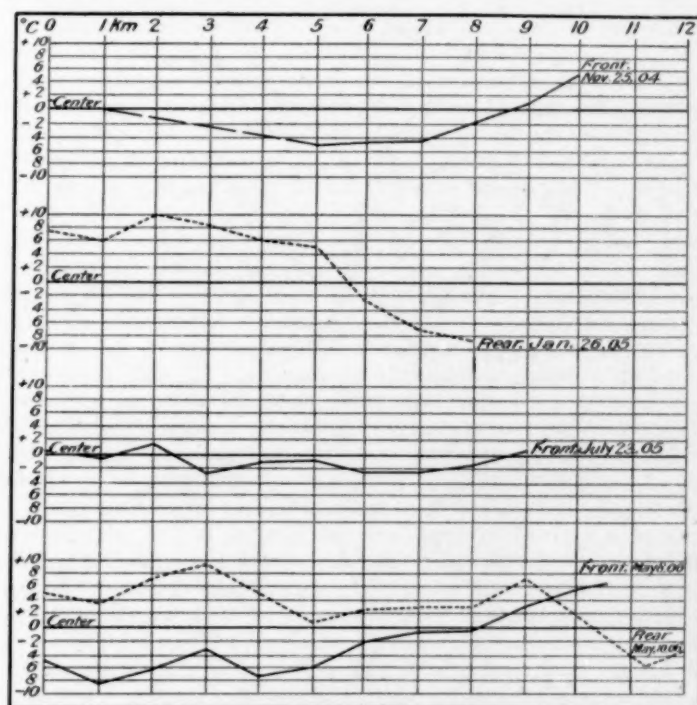


FIG. 2.—Departures of temperatures in front and rear of anticyclones from the temperatures at the same altitudes in the central area.

central area of the anticyclone. The diagram, fig. 2, shows that, up to about 8 kilometers altitude, the temperature was lower in front and higher in the rear than it was in the central area; between 8 and 10 kilometers the central area was colder than either the front or the rear; while above 10 kilometers the lowest temperature was in the rear of the anticyclone and the highest in front, this condition being the reverse of that near the earth's surface.

The explanation of these facts which suggests itself to me is that the cold air in the northern part of the anticyclone is moving more rapidly than the anticyclone toward the southeast and, on account of its greater specific weight compared with the surrounding air, sinks toward the earth's surface, the center of the anticyclone being about midway between the northwestern and southeastern limits of the inclined stratum of cold air. The circulation of air around a central area is confined to a stratum within about 2 kilometers of the earth's surface.

In the second diagram, fig. 3, are shown the movements of

the air at different heights both in anticyclones and cyclones, as derived from the observations of cloud movements at the Blue Hill Observatory. This is reproduced from the *Beiträge zur Physik der freien Atmosphäre*, Band II, Heft 2, 1906, being

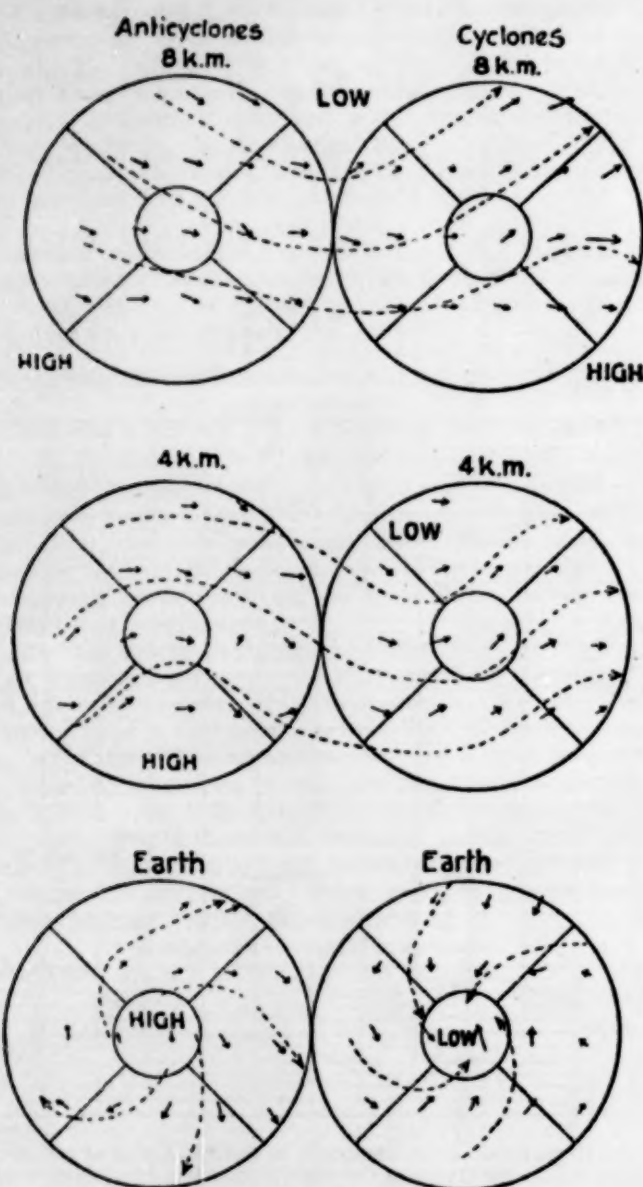


FIG. 3.—Movement of the air at different heights in anticyclones and cyclones.

slightly modified from the original diagram published in the *Annals of the Astronomical Observatory of Harvard College*, Vol. XXX, Part iv, 1896.

#### BRIGHT METEORS.

Many observers and correspondents of the Weather Bureau have been in the habit of sending us observations of bright meteors, but the observations have not been utilized as completely as is desirable.

The special interest meteors have for the meteorologist consists in the fact that their visibility, due to the heat generated as they pass thru the atmosphere, demonstrates the existence of gases at great heights about which we otherwise have no information whatever; and it has always been hoped that the visible paths of meteors and the behavior of the trains that are often left behind them may tell us much about the upper atmosphere.

We are happy to state that, by permission of Prof. Henry A. Peck, the astronomer at the University of Syracuse, all good observations of meteors received by us will hereafter be forwarded to him, who will make the necessary computations and tell us whatever may be learned relative to their orbits.

Every observer who reports a meteor is requested not to fill up his account with unnecessary verbiage, but state in a simple, straight way, first, *at what exact point in the sky the meteor was last seen*. This point may be defined either with reference to the stars or the moon or sun; or by horizontal angular bearings and vertical altitudes, such as are measured with engineering instruments; or by reference to certain trees, buildings, or other marks, whose linear distances and altitudes are known, so that angular bearings and altitudes may be calculated. One of the most convenient methods of estimating angular altitudes to the nearest whole degree consists in holding a graduated yardstick vertically at arm's length. Record the distance from the eye and the vertical distance on the yardstick above the line drawn from the eye to the horizon, from which the astronomer can easily get some idea of the angular altitude. Having fixed the point of disappearance, then record as nearly as possible the point of appearance, and in fact several points along the path, such as the point where it crossed the north-south line and the east-west line, and especially the point where it approached nearest to the zenith. By marking the shadow of a pole or of the corner of a building one may secure a good record of the path of a very bright meteor. Continuous photographic records of meteors are peculiarly desirable.—C. A.

#### INTERNATIONAL AND LOCAL ORGANIZATIONS FOR THE PROMOTION OF SEISMOLOGY.

The German Ambassador at Washington, and the United States Ambassador at Berlin, have officially announced to the Department of State, under date of March 7, that Prof. Luigi Palazzo has accepted and entered upon his duties as vice-president of the permanent committee of the International Seismological Association. The financial agent of this association is the "Aktiengesellschaft für Boden-und Kommunkredit", at Strassburg, to whom all subscriptions should be paid. The United States is a member of this association, and a small appropriation has been made by Congress for fees and the expense of the delegate. Prof. Harry Fielding Reid, of Johns Hopkins University, is the member of the permanent committee representing the United States.

Two notable steps have been taken during the past year tending to a more definite and permanent organization of seismological interests in the United States. First, as a direct result of the California earthquake, the Seismological Society of America was organized, with headquarters at the University of California, Berkeley. The objects of the society are stated to be:

"For the acquisition and diffusion of knowledge concerning earthquakes and allied phenomena, and to enlist the support of the people and the Government in the attainment of these ends."

Prof. Geo. D. Louderback, of the University of California, is the present secretary. The other officers are:

#### Board of Directors—1907.

George Davidson, *President*; Andrew C. Lawson, *1st Vice-President*; T. J. J. See, *2d Vice-President*; Alex. G. McAdie, *3d Vice-President*; J. N. LeConte, *Treasurer*; Chas. Burkhalter, W. W. Campbell, C. Derleth, jr., G. K. Gilbert, A. O. Leuschner, J. S. Ricard.

#### Scientific Committee.

Andrew C. Lawson, *Chairman*; John C. Branner, G. K. Gilbert, C. Derleth, jr., J. N. LeConte, A. G. McAdie, H. F. Reid.

The second important advance was made at the December meeting of the American Association for the Advancement of Science, when, at the instigation of Prof. W. H. Hobbs, of Ann Arbor, Mich., a committee on seismology was appointed. The gentlemen selected, who represent all sections of the country and the more important institutions likely to be engaged in seismological research, are as follows: L. A. Bauer, Carnegie Institution of Washington; W. W. Campbell, Lick Observatory; Major C. E. Dutton, U. S. Army; G. K. Gilbert, U. S. Geological Survey; J. F. Hayford, U. S. Coast and Geodetic Survey; W. H. Hobbs, University of Michigan; L. M. Hoskins, Stanford University; T. A. Jaggar, Massachusetts Institute of Technology; Otto Klotz, Ottawa Observatory, Canada; A. C. Lawson, University of California; C. F. Marvin, U. S. Weather Bureau; W. J. McGee, St. Louis Public Museum; H. F. Reid, Johns Hopkins University; C. J. Rookwood, jr., Princeton University; and R. S. Tarr, Cornell University. In the preliminary organization of the committee Dr. G. K. Gilbert was chosen chairman and Dr. W. H. Hobbs, secretary.

Some of the objects in view in forming the committee on seismology in America are as follows:

1. To be available for, and to initiate counsel in connection with, legislation which provides for investigation of earthquakes or the means for mitigating their dangers.
2. To bring into harmony all American and Canadian institutions doing seismological work, and to guard against unnecessary duplication of studies.
3. To organize, if thought best, a correlated system of earthquake stations, which should include the outlying possessions and protectorates.
4. To advise regarding the best type or types of seismometers for the correlated stations.
5. To disseminate information regarding construction suited to earthquake districts.
6. To collect data regarding the light as well as the heavy shocks, and to put the results upon record.
7. To start investigations upon large problems of seismology.
8. To advise with some weight of authority when catastrophic earthquakes have wrought national calamity.—C. F. M.

#### THE METEOR OF MARCH 14, 1906, OVER CENTRAL NEW YORK.

By Prof. HENRY A. PECK. Dated Syracuse University, Syracuse, N. Y., May 1, 1907.

About 8 p. m., March 14, 1906, a large meteor past over the western-central part of New York State. Press notices appeared in the majority of the daily papers between Rome and Buffalo. In an attempt to secure more reliable data requests were sent from the Central Office of the Weather Bureau to the officials in charge at Oswego, Ithaca, Syracuse, and Rochester, asking them to send all good accounts of the meteor, together with apparent angular altitudes and bearings. Scattering observations were obtained from the three first named stations. In response to advertisements in the Rochester papers, Mr. L. M. Dey, the local forecaster, was enabled to obtain a large amount of material which has been of great value in roughly outlining the territory over which the meteor was observed, as well as in determining the general character of the phenomenon. A complete list of those who have contributed to secure the following results is here given, the places of observation being arranged in order of longitude west of Greenwich:

Henry B. French, Rome.  
J. W. Blood, Rome.  
L. W. Griswold, Oneida.  
H. A. Peck, Syracuse.  
Jennie Whaley, Oswego.  
Olive E. Templeton, Oswego.  
F. R. Monk, Fair Haven.  
S. D. Colgate, Townsendville.  
Benjamin Christian, Wolcott.

Robert J. Purdy, Ovid.  
Floyd Thomas, North Rose.  
Louis H. Albright, Newark.  
J. A. Rose, Lyons.  
C. J. Andrews, Sodus Center.  
Fred Webber, Sodus Center.  
Professor LeRoy, Penn Yan.  
Olive R. Tobey, Penn Yan.  
V. C. Washburn, Clifton Springs.

F. W. Clark, Williamson.  
Rev. J. Menladyke, Palmyra.  
J. Van Aersdale, Canandaigua.  
Mrs. Addie Eddy, Middlesex.  
C. D. Gilbert, Despatch.  
B. A. Plimpton, Victor.  
Mrs. Jesse A. Wheeler, Holcomb.  
Benjamin G. Wedd, Mortimer.  
William B. Mason, Lima.  
Jesse L. Vanderpool, Rochester.  
L. M. Dey, Rochester.  
F. L. Hunt, Rochester.  
Kate E. Collins, Rochester.  
Julia F. White, Rochester.  
H. B. McEnbee, Rochester.  
Mrs. T. Tewilliger, Rochester.  
Mrs. F. B. Albro, Rochester.  
Mrs. Chas. T. Axelson, Rochester.  
Mrs. George Heberling, Rochester.  
Adaline I. Jones, Rochester.  
Katherine L. Hoyt, Rochester.  
Mrs. G. T. Le Boutillier, Rochester.

F. T. Ellison, Rochester.  
S. F. Gould, Rochester.  
A. E. Benjamin, Rochester.  
Edgar Shantz, Rochester.  
C. J. Trumeter, Rochester.  
Louis P. Hof, Rochester.  
F. W. Green, Rochester.  
H. H. Butler, Rochester.  
Frank J. Schantz, Rochester.  
Milton J. Tripp, Rochester.  
Mrs. H. H. Turner, Rochester.  
B. L. Pope, Rochester.  
Leman Gibbs, Livonia Center.  
George V. Witzel, Coldwater.  
F. Hanford, Scottsville.  
W. J. Stocum, Adams Basin.  
John Denton, M. D., Retsof.  
Ames Belden, Albion.  
Georgianna A. Nichol, Medina.  
Mrs. Thomas R. Griffith, Aurora.  
Thomas Rooney, Lockport.  
F. A. Keltinger, M. D., Lockport.

When it is remembered that the air-line distance from Rome to Lockport is over 160 miles, it is evident that the meteor was a remarkable object from a popular as well as from a scientific standpoint.

The apparent path of the meteor thru the atmosphere began about 4 miles to the southeast of Geneva on the eastern shore of Seneca Lake, at an altitude of 70 miles above the surface of the earth. The time of flight was about five or six seconds, and it disappeared over Lake Ontario northeast of Manitou Point, about 8 miles from the nearest land. At first it appeared as a rosy red star of not inconsiderable brightness, but in the latter part of its flight various observers estimated its size as from that of quarter to the full size of the moon. The light cast at places near its path was evidently as strong as that of the moon, or, as one observer says, "the beam of a strong searchlight". Some doubt might be cast on its having been one large, solid body from the fact that reports from places widely apart state that fragments seemed to leave the main mass and pursue separate paths. As suggested by Mr. L. M. Dey, official in charge of the Weather Bureau office at Rochester, this may be the cause of some of the conflicting accounts as to its course, some observers having seen fragments of the parent body. A trail that persisted for several seconds followed the flight. A number of observers report that it made a sound as of some heavy body rushing thru the air. After passing over Lake Ontario it exploded twice, the detonation being heard 40 miles, while within 25 miles the concussion was so great as to cause a slight shaking of houses. The sound at Rochester and vicinity is compared to the sound of distant cannon or blasting, or to the rolling of thunder.<sup>1</sup>

To obtain the orbit of such an object, using as the basis the conflicting observations and estimates of persons who, for the most part, are unskilled in such work, is no easy task. It must be remembered in the present instance that the greater share of the accounts were not compiled from notes made at the time of observation, but were compiled from memory about three weeks later. Under such circumstances the observer will often unconsciously and in perfect good faith prolong the true path in either direction.

Our work falls into two divisions. We must first find the most probable path thru the atmosphere, assuming that path as a straight line, from which, in any event, it can not deviate very materially during the short time of flight. This straight line is fixed if we know its end, its length, and its direction. The known time of flight furnishes the velocity. The second

<sup>1</sup> A great noise is sometimes heard shortly after a large meteor passes the observer, and as meteors are frequently seen to break into two or more portions such noises are spoken of as concussions or explosions, especially because they are so loud as to resemble cannonading. However there is generally no explosion, properly so called, even when the noises are very loud; and the exact mechanism by which the noises are produced is worthy of further study.—C. A.

part of the work is the computation of the orbit pursued by the body before it encountered the earth. This can be accomplished by the well-known formulas of theoretical astronomy, provided we know the velocity and direction of its motion when it fell under the earth's attraction.

The end of the flight is very definitely fixed by the observations made at Rochester. Mr. Vanderpool was making his evening observation at the weather station when the flash of light was noted by him at seven hours and fifty-six minutes, eastern time. He estimated that the detonation was heard ninety seconds later. This is confirmed by Kate E. Collins, who estimated the time as eighty-five seconds, and later verified her estimate by walking again the distance she past over between the flash and the subsequent report. This places it 18 miles from Rochester. Mr. L. M. Dey, the official in charge of the Weather Bureau office at Rochester, states that its course was nearly due north, and that the disappearance took place 20° above the horizon. This makes the geographic coordinates of the point of disappearance

$$\lambda = 77^\circ 37' \text{ west of Greenwich,}$$

$$\varphi = 43^\circ 24' \text{ north,}$$

and the geocentric coordinates

$$\log. \rho \sin \varphi' = 3.434$$

$$\log. \rho \cos \varphi' = 3.461$$

the reduction of the latitude to geocentric position being eleven and one-half minutes, and the sidereal time

$$\theta = 108^\circ 6',$$

while the height above the lake was 6 miles.

This completely defines one point on the line described by the meteor. As soon as another point is found the direction of this line is also established.

If one were at the place where a meteor fell to the ground, he would see it approach as a rapidly brightening and enlarging object, but would not see it describe any apparent path on the sky. The projection of the straight line would be reduced to a point, and this point from which it would seem to approach is called the radiant. It is apparent that the place where the meteor first encountered the atmosphere must be in the direction of the radiant. The apparent curve seen by an observer at any other station is the projection of the line joining the radiant and the point at the end of the flight. As the plane of this projection must always contain the line that is projected, the real path of the meteor must lie in the planes of all the apparent paths, i. e., it must be their common line of intersection. This is the underlying idea in Galle's classical method of computing a meteor orbit. A corollary to this proposition is that the great circles of which the various observed apparent paths are arcs must have a common point of intersection. This point is the radiant, and its determination completely establishes the direction of flight.

In the present case, after careful consideration of the observations, I have chosen those made at Rochester and Syracuse as the basis of the computation. The Syracuse observation must have been made very nearly at the instant when the meteor entered the earth's atmosphere. The azimuth was 67° west of south and the altitude was 60°. Since the point of disappearance is so well established we may abandon all observations of this portion of the path and compute by well-known formulas the direction in which the meteor should have been observed the instant before extinction. As viewed from Syracuse this point had the coordinates

$$\text{Right Ascension} = \alpha = 9^\circ 54'$$

$$\text{Declination} = \delta = +17^\circ 9'.$$

and the azimuth and altitude of the point of first appearance is equivalent to

$$\alpha^1 = 78^\circ 36'$$

$$\delta^1 = +26^\circ 38'$$

In order to find the plane of the great circle defined by these two points the requisite formulas are

$$\tan \gamma \sin (\alpha^1 - I') = \tan \delta^1$$

$$\tan \gamma \cos (\alpha^1 - I') = \frac{\tan \delta - \tan \delta^1 \cos (\alpha - \alpha^1)}{\sin (\alpha - \alpha^1)}$$

where  $\gamma$  represents the angle between the plane of the great circle and the plane of the equator while  $I'$  is the right ascension of the node. In the case of the Syracuse observation we have

$$\gamma = 150^\circ 33'$$

$$I' = 153^\circ 28'$$

The question as to whether the node is ascending or descending is settled by the fact that its general course was from south to north and the ambiguity as to the tangent of  $\gamma$  is removed by its course being retrograde in right ascension.

Treating the Rochester observation in the same manner we have

$$\alpha = 288^\circ 6'$$

$$\delta = +66^\circ 50'$$

Mr. L. M. Dey states that the meteor past Rochester a "little to the east of the zenith, and had an angular altitude of 60° or 70°". I have preferred to take his estimate rather than any that I could form from the conflicting reports of observers, as he had a chance of interviewing persons soon after the meteor was seen. Reducing this estimate,

$$\alpha^1 = 140^\circ 42'$$

$$\delta^1 = +38^\circ 19'$$

and, therefore,

$$\gamma = 79^\circ 53'$$

$$I' = 132^\circ 38'$$

The fact that at Rochester the projection was to the east of the meridian changes the quadrant of  $\gamma$ .

The mathematical condition that the radiant shall lie on the great circle is expressed by the condition

$$\sin I' \sin \gamma \cos D \cos A - \cos I' \sin \gamma \cos D \sin A + \cos \gamma \sin D = 0$$

In the present instance we have two such equations and therefore  $A$  and  $D$ , which are the right ascension and declination of the radiant, become definitely known. If more than two observations are used there arises a condition which must be solved along the lines of the least square method. If we place

$$\cotan D \cos A = x$$

$$\cotan D \sin A = y$$

the equations reduce to the form

$$ax + by + c = 0.$$

For the two observations under discussion the equations are

$$+0.206x + 0.412y - 0.887 = 0$$

$$+0.724x + 0.667y + 0.176 = 0$$

and from the solution results

$$A = 134^\circ 26'$$

$$D = +9^\circ 32'$$

The direction of the line in space being found, its length may then be computed, which is 86.7 miles.

The time of flight was estimated in Syracuse at from five to six seconds. This is confirmed by other observers. Assuming it as five and one-half seconds, the velocity thru the atmosphere was 15.8 miles per second.

The direction and velocity just found are not those that the meteor possessed in space before it felt the attractive force of the earth. These must be found before the orbit with regard to the sun can be determined. The orbit described after the body has fallen under the influence of the earth is a conic section, whose focus is the center of the terrestrial sphere. The

apparent velocity differs from the true velocity also because the earth is itself in motion. When these two causes are taken into consideration the true radiant is found to be the point whose celestial longitude and latitude are, respectively,

$$106^{\circ} 2' \\ + 3^{\circ} 42'$$

and the true velocity is 31 miles per second.

As will be noticed, the velocity is about 20 per cent in excess of that to be ascribed to parabolic motion, and places the meteor in the hyperbolic class. I am perfectly aware that the burden of proof rests upon the person that assumes hyperbolic velocity for cosmic bodies, but as the assumption of a parabola would prolong the time of visible flight by two seconds, I have preferred to retain the velocity as above given. Computing the elements by the known formulas of theoretical astronomy we have

Longitude of ascending node	351° 31'
Inclination to ecliptic	4° 0'
Longitude of perihelion	209° 1'
Logarithm of perihelion distance	9.9434
Eccentricity	1.696

If one is disposed to reject the hyperbolic velocity from general principles, the orbit is not varied more than might easily arise from the uncertainty of the observations, and there results

Longitude of node	351° 31'
Inclination to ecliptic	2° 58'
Longitude of perihelion	206° 21'
Logarithm of perihelion distance	9.9597

#### COOLING BY EXPANSION AND WARMING BY COMPRESSION.

By CHARLES EMERSON PEET. Dated Lewis Institute, Chicago, Ill.  
(Reprinted from School Science and Mathematics, April, 1907, page 263.)

The following method of cooling by expansion and condensation of the water vapor of the air into a visible cloud of water particles may be of interest to instructors in physiology. It is a method which I have used with success for several years. The apparatus necessary is: (1) an air pump. (2) a bell jar. (3) a bottle with a snug fitting cork, coated with vaseline. The bottle is corked and placed under the bell jar and the air is exhausted from the bell jar. The cork is pushed out of the bottle by the air inside. The sudden expansion causes cooling enough to condense the water vapor into a cloud which remains visible for a considerable time. Slow leakage of the air into the bell jar may produce warming by compression enough to reevaporate the water. This warming by compression is made more striking if the bell jar is provided with a stop-cock by which the air may be admitted more rapidly and in a manner which is apparent to the class. The success of the experiment varies with the humidity of the air, but under the most unfavorable circumstances it is never an entire failure. The size of the bottle to be used and the force with which the cork should be forced into it can easily be determined by trial. The cloud in the bottle may be made more clearly visible by providing it with a proper background.

#### ESPY'S NEPHELOSCOPE.

The experiment above described by Professor Peet implies the use of an air pump, whereas the following method, which has often been used by the Editor, not only requires no expensive apparatus, but has several other advantages. A bottle (A) properly corked, has inside of it an ordinary elastic-rubber toy balloon (B), which, when but slightly distended, occupies only two or three cubic inches. A glass (or preferably a rubber) tube enters the mouth of the balloon, and also passes outward air-tight, thru the cork. On blowing thru the tube, or

forcing air by any other method into the balloon, the latter is distended, and of course the air within the bottle is compressed. Wait until this compressed air has lost its warmth, which it quickly does by conduction and radiation to the sides of the bottle, then remove the finger from the rubber tube and allow the compressed air of the bottle to push the air within the balloon outward thru the rubber tube. The work done by this expansion cools it enough to produce the most delicate cloud of condensed vapor, which is visible until the radiation of heat from the sides of the bottle evaporates the globules of water. The experiment may be repeated over and over with the same air always in the bottle; and if a thermometer be added, together with some way of measuring the volume of compressed air, then really instructive computations may be made. If a little water be kept in the bottle, but outside the balloon, we may arrange so to deal always with saturated air, and the haze will be more easily visible to a large class. If no water be present then we have to deal with unsaturated air, and may make a large variety of experiments.

One of the first phenomena that the teacher and scholar will note is the fact that after a few trials it becomes more and more difficult to secure any visible haze. This is the phenomenon first recorded by Espy, and was a mystery to him and everyone else until Aitken showed that vapor condenses most easily on minute solid nuclei, and by its weight carries them to the bottom or sides of the jar, where they stick fast, so that after a few trials no more nuclei remain. Then comes the phenomenon first studied by C. T. R. Wilson, of Cambridge, England, who showed that in dustless air a greater expansion and therefore a greater cooling is necessary in order to produce visible globules. This may lead us on to the consideration of ions, if the scholar is far enough advanced for the subject. At least it is proper to call his attention to the fact that the interior of a cloud is dustless, and that here greater expansion seems to be necessary, and consequently greater cooling, and that therefore a greater liberation of latent heat occurs within the interior of a thundercloud than in that same air when it first rises high enough to become cloudy.

Instead of water one may introduce other liquids into the experimental bottle, which is in fact a modification of Espy's single nepheloscope, and may thus experiment upon carbonic acid gas, the vapors of alcohol, ammonia, etc.

The double nepheloscope devised by Espy may be imitated by connecting two clear glass bottles (C) and (D) by means of two rubber tubes to a central bottle or receiver (E), from which the air can be exhausted. By a spring clip close one tube so that the air may be exhausted from the receiver (E) and one bottle (C), while not exhausted from the other bottle (D). Then remove the clip from (D) and allow its air to pass over into (E) and (C). The student will be surprised to find that no cloud is formed. This experiment troubled Professor Espy very much about 1850, as he had up to that time been reasoning on the general principle that the atmosphere is cooled by the act of expansion, but here he evidently had expansion without cooling. It was Prof. William Thomson, of the University of Glasgow, now Lord Kelvin, who, by his work on thermodynamics, first gave the true explanation, namely, that it is not the mere expansion that produces cooling but the work done by expansion. When the air expands from (D) into the vacuum (E) and (C) there is no work done except the moving of about one-half the mass of air in (D) over into the empty jars (E) and (C), and the cooling is too slight to produce a visible haze; it was, in fact, too slight for Espy to measure with his most delicate thermometer. On the other hand, when the compressed air in the bottle (A) pushes the air in the balloon (B) out into the open air it is doing heavy work by pushing against the outside atmospheric pressure, just as does the steam in the cylinder and boiler of an engine.—C. A.

# METEOROLOGICAL STATIONS IN SOUTHERN RHODESIA.

The organization of an independent meteorological service in Southern Rhodesia appears to have begun in 1901. Previous to that year the few stations in existence reported their results directly to the Meteorological Commission of the Cape of Good Hope. The reports for 1901, however, were collected by the government statist at Salisbury and forwarded by him to Cape Town for publication in the annual report of the Meteorological Commission. Nineteen stations of all orders were then in operation. With 1903 began the publication of the annual "Report on Meteorology by the Statist", devoted exclusively to the meteorology of Southern Rhodesia. This has since appeared regularly, except for a gap of one year, ending March

31, 1905. Concurrently, results from Southern Rhodesian stations have been published annually in the Report of the Meteorological Commission of the Cape of Good Hope.

Mr. J. S. Blackwell, acting statist, has been good enough to send the writer a manuscript map showing the location of all meteorological stations in Southern Rhodesia at the beginning of the year 1907. This is reproduced in a somewhat simplified form in fig. 1, herewith, and supplements in an important manner the published reports of observations in the colony, as several of the stations are located at places not shown on any of the ordinary maps of Southern Rhodesia. Of the 48 stations shown on this map only three—Bulawayo, Salisbury, and Hopefountain—have been in operation ten years.—C. F. T.

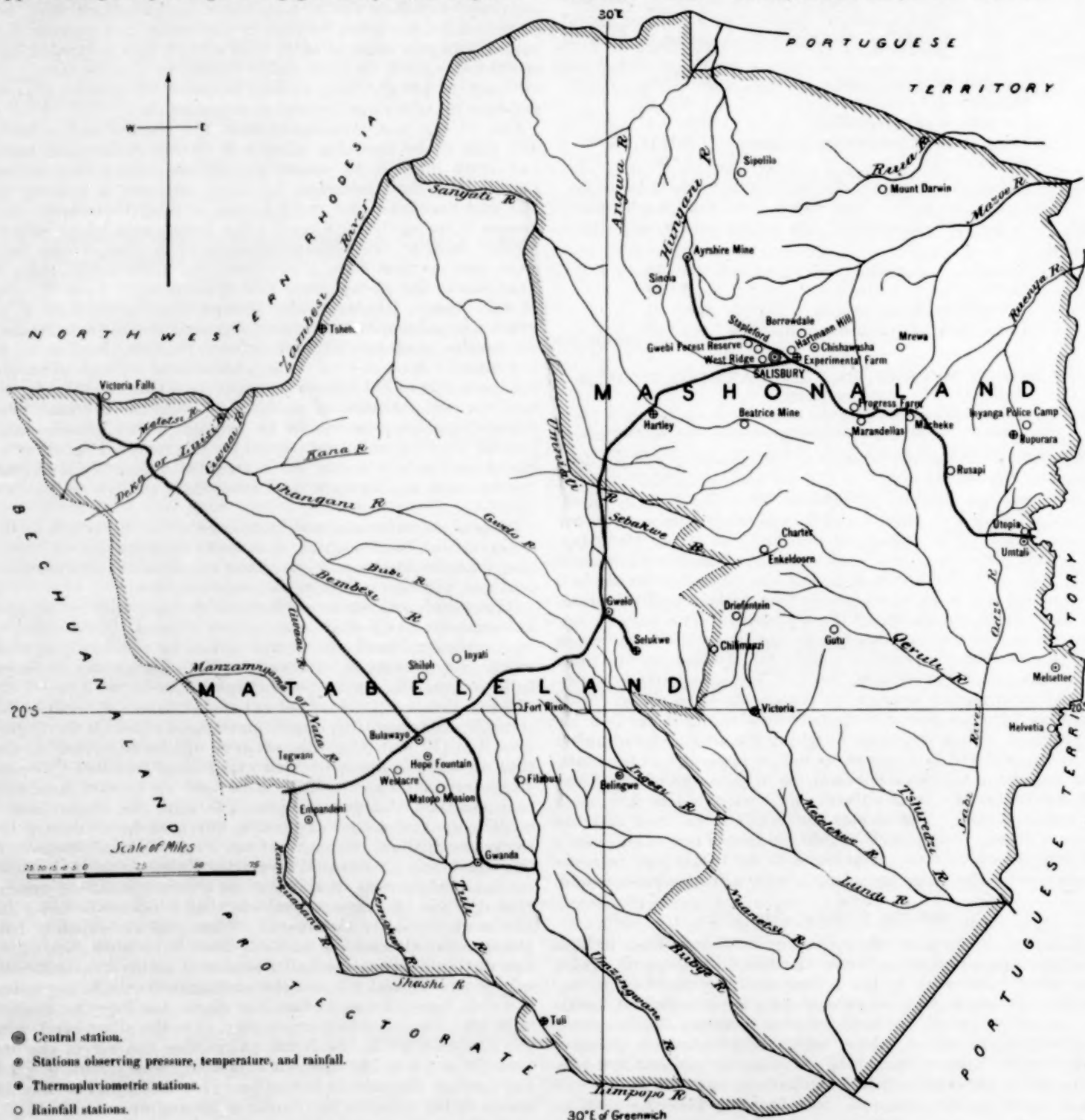


FIG. 1.—Map showing location of meteorological stations in Southern Rhodesia, January 1, 1907.

### A CLOUD BANK AT SEA.

The Chief of the Division of Ocean Meteorology contributes the following extract from a record lately received by him:

At 2:30 a. m. of March 14, in crossing the North Sea from Copenhagen to North Shields, we witnessed a phenomenon of which I give you the following account:

Throughout the whole night it had been snowing heavily. At the above-named time we saw about a mile ahead of us (the ship's course at the time being SW. by W.  $\frac{1}{2}$  W.), lying on the water and rising to the height of the ship's rail, a sharply defined bank of clouds or some other object, having perfectly square edges, and extending from SW. by W.  $\frac{1}{2}$  W. to WSW., the remainder of the horizon being quite clear. Unable to decide what the object was, we brought the ship's head to WNW., and left it on our port beam. Immediately afterwards it started to blow very hard. Neither the chief officer nor myself had ever seen anything like it before. Barometer at the time 29.47 inches, wind WNW., force 4 to 5, and then increasing.—*Brilliant* (Ger. S. S.), Schroeder, report by Third Officer Leidhold.

### NORMALS IN WEATHER BUREAU RECORDS.

A correspondent addresses the Chief of Bureau as follows:

Kindly inform me what is the standard for normals of pressure, temperature, and rainfall referred to in Table I of the MONTHLY WEATHER REVIEW. I presume that it is the mean of certain periods accepted as normal. If so I should like to learn of the locus and length of these periods, and whether the application of the + or — departure to or from the monthly record is supposed to give the normal as a result.

In reply, the Division of Meteorological Records states that the values used as normals are the averages of all observations available from the beginning of record at the respective stations to the time the values were completed and put in operation. The normals of pressure now in use cover the period from 1873 to 1899, inclusive. Some stations contain the full 27-year record while the values for other stations are based on shorter periods. For temperature and precipitation the value used as normals cover the period from 1871 to 1895, inclusive. Some cover the entire period of twenty-five years, while at others the values are for shorter periods depending upon the dates upon which observations began at the several stations. As a rule normals are not prepared for stations having a record of less than ten years.

In computing these normals no attempt has been made to reduce the values at stations having shorter records to correspond with those covering the full period of years.

### A PLEA FOR THE TEACHING OF METEOROLOGY.

By R. H. CURTIS, Esq.

[Reprinted from Symons's Meteorological Magazine, November, 1906.]

The growth of an intelligent interest in meteorology on the part of the general public is manifesting itself in several ways. One very unmistakable sign of it, which everyone may note, is to be found in the amount of attention which is now paid to the subject of the weather by the daily press, and particularly to the forecasts of the weather published every morning. Not so very long ago there were comparatively few people who troubled themselves to look at these forecasts at all, and the majority of those who did do so regarded them as little more than guesses, generally good guesses, perhaps, because they were understood to have been made by people who had given more than ordinary attention to the subject, and presumably had by dint of long practice acquired more skill in reading the signs of coming changes in the weather than ordinary folk possessed; but they were rated as guesses nevertheless, with no more really scientific basis than existed for the predictions of "Old Moore".<sup>1</sup> But to-day the change is great. The forecast is the first thing looked at by thousands of men and women when they open their morning paper at breakfast, or

in the train, or on their way to business; and these forecasts are treated with respect as being scientific deductions from observed conditions of the atmosphere, considered in relation to the laws, as far as they are known, by which the movements of the atmosphere are governed. That is the gist of the reply which probably the majority of those who study the forecasts would make if asked to give their opinion about them, although, likely enough, very few could go a step further and give even the most elementary account of the laws themselves. It is, however, a step in advance that the public mind is beginning to accept the fact that there are any "laws" at all in the matter, and to recognize that the daily sequence of weather is not simply fortuitous, the result of the purest chance. When so much is admitted, a desire on the part of many to get some sort of acquaintance with the laws is sure to follow, and the day when all ordinarily well educated people will possess at least some elementary ideas of a sound nature about meteorology will thereby be brought considerably nearer.

But signs of the spread of this spirit of enquiry are not wanting even now, and its progress would seem to be more real than possibly many meteorologists suppose. Indeed it may not be amiss to express the hope that some meteorologists may themselves be stirred to acquire a better knowledge of the theoretical side of the subject than they already possess, for it is not an unknown experience to meet with men who make daily observations of the barometer and of temperature, who have a rain gauge, and know all about the rainfall of the district in which they live, and who locally have the reputation of being "meteorologists", but who nevertheless would be sorely puzzled if asked to describe a typical "depression", or to explain what is known as "Buys Ballot's law".

Anyone passing the Meteorological Office in Victoria street might see at almost any time in the day people stopping at the door, not merely to scan the forecasts exhibited there, but also to study the charts hung by their side, upon which the forecasts are based. Not infrequently when friends are examining these charts together, an interesting discussion, or perhaps explanation, may be heard regarding the relation of the forecast to the conditions indicated by the chart; it is not always that these explanations proceed upon orthodox lines, although frequently they do; but, be that as it may, they show that the broad principles of the subject are receiving some attention, and to that extent they are welcome indications of progress to all who are interested in the furtherance of the study of meteorology.

Another and still more promising indication of progress may also be noticed at the door of the Meteorological Office, at a particular part of the day, when the students from a neighbouring training college for schoolmasters going for, or returning from, their daily walk, gather in small groups round the charts, discussing the sequence of changes shown during the past few days, and sketching in their note books the present distribution of pressure and temperature, and the wind circulation, with a view to subsequent class lectures on the subject. In the direction which this fact indicates lies, we think, the great hope of popularizing the science of meteorology. Hitherto it has been almost entirely omitted from the curricula of our schools, and from the training of the teachers. Smatterings of it have found their way into that olla-podrida of the sciences which under the name of "physiography" has for years been a favourite subject with school teachers in the annual South Kensington Science examinations; but since in addition to meteorology the paper on this subject usually embraces questions in astronomy, geology, vulcanology, chemistry, and possibly other branches of science as well, it is obvious that the modicum of knowledge of each which a student who aspired to grapple with such a "general knowledge" paper would probably acquire, would be insufficient to enable him to teach any of them.

<sup>1</sup> Mr. Curtis here refers to a famous almanac published in the seventeenth century.—EDITOR.

But why should not meteorology now be regarded as a science sufficiently mature to be able to stand upon its own feet, and why should not school teachers be encouraged to take a course of study in meteorology as complete as is now usual in the case of botany or physiology? Teachers would then have a real acquaintance with the subject, and would be able to impart their knowledge satisfactorily to their pupils; and without doubt both teachers and taught would find the subject at once interesting and useful.

There are teachers who have already made this discovery and have profited by it. Of course in some schools, such as those for young seamen, or those for students of agriculture, meteorology naturally secures a prominent place; but in some "public elementary" schools the subject is also taught so far as first principals are concerned, and the interest of the pupils is further secured by getting them to observe instruments which have been provided as part of the school equipment.

In this country we, as a rule, move slowly, and although the inclusion of meteorology in the ordinary curriculum of school instruction has been advocated for many years, very little has yet been done to bring it about. But the growth of general interest in the subject to which we have drawn attention should we think aid materially in its accomplishment, and with the further development of that interest the time when meteorology shall form a common subject in schools of all grades should not be very distant.

#### ON "ABSOLUTE" VALUES.

In looking over the files of the section reports we notice a growing use of the word "absolute" that seems to be without official authority and that should be stopt, as it is objectionable for several reasons. The terms "absolute maximum" and "absolute minimum" frequently occur in climatology to express the highest maximum and lowest minimum that have occurred in a long series of observations at a given place. The difference between these extremes is the "absolute range" for that long period, and the term "absolute" is applicable only to a series of observations that is so long that the extreme temperatures and ranges may be supposed to approximate what would be given by a century or more of observation.

We use the expressions "maximum", "minimum", "extremes" for any given month or year, or for a short series of months or years, and always specify what that special period is.

In his translation of Hann's "Climatology" Prof. R. De C. Ward, on page 18, seems to apply the term "absolute" to a short series, but he does not intend this, as may be seen from the fact that he states that these data have very little value unless they are based on a long series of observations; and he illustrates the meaning and use of the word "absolute" on the next page by applying it to a series of ten years, while in the table on page 33 the term is applied by Hann only to a record of forty-six years. In the circular letter sent out by Prof. A. J. Henry, when gathering data for his Bulletin Q,<sup>1</sup> he called for "absolute maximum and minimum" in his temperature tables, but only expected these data from stations having long records.

As the use of the word "absolute" is liable to convey wrong impressions it has been strongly recommended that the simple expressions "maximum", "minimum", "range" for the month or the year, or a given number of years, be adopted for general use, and that the term "absolute" be left for special memoirs on climatology, where distinctions must be made between the periodic and nonperiodic features of climate.

In the best usage the word "absolute" refers to a single station and the oscillations thereof during a long period of time, but we notice a remarkable innovation in many of our

<sup>1</sup> "The Climatology of the United States", not "A Climatological Dictionary", as some erroneously call it.

section reports, where the term "absolute" is applied to variations over a large area, as over a State or section; thus, "the absolute maximum temperature for the State is 101° and the absolute minimum 45°". But a section rarely has more than a hundred stations, and no one can be sure that there are not many points in the State at which our extremes are exceeded. The term "absolute" is as inappropriate to our State sections as it is to our short records. One should simply say "highest recorded", "lowest recorded" in the State, without using the word "absolute", and should give the station and date as well as the temperature.

We note other peculiar phrases that are also objectionable; for instance, one section director instead of saying the "absolute highest" or "absolute maximum" writes the "highest absolute temperature" or the "lowest absolute temperature". Now the "absolute temperature" is a term long since pre-empted both by physicists and by meteorologists, and means the temperature counted upward from the absolute zero, as distinguished from the temperature centigrade, which is counted upward or downward from the freezing point, or as distinguished from the Fahrenheit scale where the temperature is counted upward or downward from the zero point chosen by Fahrenheit. The absolute temperature is usually found by adding 273 to the centigrade temperature; it would come to the same thing if we should add 459 to the Fahrenheit temperature. As the term "absolute temperature" is everywhere in common use it would be foolish to allow a new and loose usage to prevail in meteorological literature.

The phrases, "highest absolute maximum" and "lowest absolute minimum", are redundant and should be replaced by the simple expression "highest" or "lowest", omitting the word "absolute" as improper, and the words "maximum" or "minimum" as unnecessary. It is much clearer and more definite to say, "the highest temperature of the month at the station", or "the highest temperature recorded in the State" or "the maximum temperature for the State".

In another report we read, "the absolute minimum, 29°, at ———, is the lowest in fifteen years". It would be shorter and just as well to say, "29°, at ———, is the lowest recorded in fifteen years", omitting the words "absolute minimum".

Again, we read "the absolute maximum temperature for 1906", as tho the absolute maximum could occur, not merely once in a century, but once every year. The proper expression is "the highest temperature in 1906", or "the maximum temperature during 1906".

In another line occurs the expression "the highest absolute temperature for November, 1906, in the State of ———", as tho absolute temperatures could occur at every station, but the highest absolute could characterize some one point in the State. It would be a great deal better to say, "the highest temperature in the State during November, 1906".

From another report we quote an "absolute range of 100° in temperature for the month of February". The writer of this line evidently intends to say that the range of temperature for the month between the lowest at one station and the highest at another station somewhere within his section was 100°, and that this was the largest of all similar records for that month. His word "absolute", therefore, includes both the idea of time and geographical extension—not either one alone, but both. Now such a combined chronological and geographical range of temperature has no local climatological value. The figures are not comparable with those for any other section because everything depends upon the sizes of the sections and their orography, whether mountainous or flat, and their shape, whether elongated north and south, or east and west. The climatologist wants the range of temperature for each individual station; by comparing these ranges among themselves he may be able to discern the differences in the climate over different parts of the section. To be sure one might imagine

that taking the State or section as a whole the maximum and minimum occurring within it and the general range for the section might be comparable with similar numbers for other sections, and that thus we might study the relative climatology of the different sections, but this has not yet been done to any great extent. We can take the average of the departures of all the stations from their respective normals, and thus obtain an average departure for the whole section, but even this has no value in climatology when the stations have a wide range in altitude, latitude, or longitude. The study of climatology is coming down more and more into details, and these so-called absolute maxima and minima by sections cover up the very details that we wish to study.

Finally we note "The absolute maximum of 95° was, with two exceptions, the lowest of record for the month, while the absolute minimum was the highest with one exception". We think that the writer was endeavoring to communicate something that had impressed him as peculiar and perhaps remarkable, as to the weather in his section during September, 1906, but we do not ourselves get any clear idea from this paragraph and we think it should be rewritten, omitting the word "absolute", and mentioning the names of the stations.—C. A.

#### ADAM PAULSEN (1833-1907).

Prof. Adam F. W. Paulsen, director of the Danish Meteorological Institute—the national weather service of Denmark—died January 11, 1907, at the age of 74.

In addition to his many other activities as the head of the Danish meteorological service and as a member of the International Meteorological Committee, Professor Paulsen was especially interested in two important projects—the study of the aurora, and the establishment of telegraphic communication between Europe and Iceland, for meteorological purposes. The cable to Iceland became an accomplished fact shortly before his death, and is a lasting monument to his memory. The discouraging financial difficulties that he had to overcome in achieving this result have been set forth in his reports to the International Meteorological Committee.

Paulsen's investigations of the aurora date from the international polar expeditions of 1882-1883, in which he took part as leader of the Danish expedition to the west coast of Greenland. In 1899-1900 he led an expedition to northern Iceland for the special purpose of studying the aurora. The results of the latter expedition included some remarkable photographs of auroral spectra, and new measurements of the altitude of the rayless auroral arch, indicating that it occurred at not less than four or five hundred kilometers from the earth's surface. At this height the atmosphere must be so rarified that ordinary electrical discharges would be impossible. In a paper<sup>1</sup> published a few months before his death Paulsen reaches the conclusion that the cause of the aurora is to be sought in an immense ionization and negative electrification of the upper layers of the atmosphere, produced by cathode rays emitted from the sun.

Professor Paulsen's successor as director of the Meteorological Institute is Capt. Carl Ryder, who has heretofore been known to science chiefly as an arctic explorer.—C. F. T.

#### WEATHER BUREAU MEN AS EDUCATORS.

The following lectures and addresses by Weather Bureau men have been reported:

Mr. S. S. Bassler, March 5, 1907, before the Cincinnati Society of Natural History, on "The weather map".

Mr. Ford A. Carpenter, March 9, 1907, before the Scholia

<sup>1</sup> Sur les récentes théories de l'aurora polaire. Résumé et critique des théories de MM. Birkeland, Arrhenius et Nordmann. Idées personnelles. (Académie royale des sciences et des lettres de Danemark. Extrait du bulletin de l'année, 1906. No. 2.)

Club, of San Diego, Cal., on "What makes the climate of San Diego"?

Mr. George M. Chappel, March 20, 1907, before the teachers and pupils of the North High School, Des Moines, Iowa, on "The work of the Weather Bureau".

Mr. David Cuthbertson, March 27, 1907, before the West Side Business Men's Association, of Buffalo, N. Y., on "The usefulness of the Weather Bureau to the commercial interests".

Mr. C. F. von Herrmann, March 23, 1907, before the Alpha Delta Epsilon Scientific Fraternity, of Johns Hopkins University, Baltimore, Md., on "The principles of forecasting the weather".

Mr. J. R. Weeks, March 18, 1907, before pupils of the Washington Street Public School, Binghamton, N. Y.; also March 21, before the successful scholarship contestants of the Binghamton Republican, on "The work of the Weather Bureau".

"Classes from universities, academies, and schools have visited Weather Bureau offices, to study the instruments and equipment and receive informal instruction, as reported from the following offices:

Meridian, Miss., March 14, 1907, the physics class from Moffat-McLaurin Institute.

Mobile, Ala., March 22, 1907, a section of the physical geography class from Barton Academy.

Salt Lake City, Utah, during March, 1907, students from the Salt Lake High School and the Latter Day Saints' University.

#### BELLS AS BAROMETERS.

We find a misleading paragraph under the above heading going the rounds of the press to the effect that "about five miles from Lebekke, in Belgium, there are some small church bells known as the 'water bells'. When they are heard distinctly in the town rain is sure to follow". With this paragraph goes a so-called "plausible popular explanation of the phenomenon", about as follows:

"If bells sound very distinctly of an evening, this points to the probability of a wet day following, since air heavily charged with moisture conducts sound better than dry air. So, too, as dense air conducts better than light air, bells sound more clearly when the barometer is high than when it is low, other things being equal; and so, too, with hot and cold air".

There are several errors in this explanation. It may be acceptable to teachers and others if we add that the intensity and quality of a sound depends primarily on the bell, and the tower in which it is hung, but only to an infinitesimal degree, if at all, on the temperature of the air, or the quantity of aqueous vapor contained therein, or on the relative humidity of the air. On the other hand the intensity of sound, observed at a distance, does depend to a very large extent on the homogeneity of the air, while the distance to which a sound is heard depends on the direction of the wind. If the air is perfectly homogeneous then the effect of a horizontal wind, which is usually feeble near the ground and strong higher up, is to bend the rays of sound out of their straight line directions. If the observer is to windward of the bell, the sound that should come to him passes over his head, and if he is to leeward the sound that should pass over his head is brought down to him. If he is to leeward of a house or island the irregularities of the wind may bend the sound wave entirely away from him. If he is in a calm stratum, as in the early morning, with the wind blowing strong above him, then he may hear no sound if he is to windward of the bell, but a more intense sound if he is to leeward. Ordinarily the air is not homogeneous, but is a mixture of warm and cold, or dry and moist masses, that is to say, a mixture of rarer and denser portions that break up waves of sound. Especially during hot sunshine does the air become acoustically opaque, that is

to say, the rays of sound, having to pass thru many alternations of rarer and denser air, are reflected and refracted at every transmission, losing in intensity at every change, so that the range of audibility of a bell is always less in sunny weather than in cloudy weather, less during the daytime than at night-time, less over the land than it is over the sea, and less over the lowlands than it is on the mountain tops. During still quiet nights, beneath a layer of clouds, the atmosphere is usually most homogeneous as to temperature and moisture; and, if there be no wind, sounds are then heard to the greatest distance. There are many peculiarities in the distribution of sound that have been especially studied in connection with fog signals on the coasts of Europe and America, but we believe all have been explained by considering the refraction of sound caused by differences of wind, by differences of density, by the presence of two currents of air passing each other, by the reflection from a sheet of falling rain, by reflection from the waves of the ocean, and by the irregularities of the land. If the audibility of distant sounds is a sign of coming rain, it is generally because the skies have become clouded over, or the wind has shifted preparatory to rain; but not because the air has become more heavily charged with moisture, nor because moist air conducts sound better than dry air, nor because the dense air of a high barometer conducts sound better than the rarefied air of a low barometer, nor because cold air conducts sound better than hot air. These four influences are negligible compared with homogeneity.

The diminution of sound is perfectly analogous to that of light. Everyone knows how easily light passes thru clear air or pure water, but it will not pass thru a mixture of air and water, such as a glass full of bubbles, or a fog or cloud, or a sheet of falling rain.—C. A.

#### RECENT ADDITIONS TO THE WEATHER BUREAU LIBRARY.

H. H. KIMBALL, Librarian.

The following titles have been selected from among the books recently received, as representing those most likely to be useful to Weather Bureau officials in their meteorological work and studies. Most of them can be loaned for a limited time to officials and employees who make application for them.

##### Anderson, Richard.

Lightning conductors; their history, nature, and mode of application. 3d ed. London. 1885. xv, 470 p. 8°.

##### Angot, Alfred.

Traité élémentaire de météorologie. 2d ed. Paris. 1907. vi, 416 p. 4°.

##### Austria. K. k. Zentralanstalt für Meteorologie und Geodynamik.

Allgemeiner Bericht und Chronik der im Jahre 1904 in Österreich beobachteten Erdbeben. No. 1. Offizielle Publikation. Wien. 1906. vii, 155 p. 8°.

##### Batavia. Koninklijk magnetisch en meteorologisch Observatorium.

Regenwaarnemingen in Nederlandsch-Indië. 27 Jaargang. Batavia. 1906. xi, 380 p. 4°.

##### Black, W. G.

Ocean rainfall by rain-gage observations at sea. General and special oceans. 1864, 1875, 1881. New ed. [Repr. J. Manchester geogr. soc. v. 14, 1898.] Edinburgh. n. d. 21 p. 8°.

##### Blanchard, Raoul.

La Flandre. Paris. 1906. viii, 530 p. 4°.

##### Bouches-du-Rhône. Commission de météorologie.

Bulletin annuel. 1905. Marseille. 1906. x, 113 p. 4°.

##### Bravo, Carlos.

... La patria Boliviana. Estado geográfica. La Paz. 1894. 204 p. 8°.

##### Cape of Good Hope. Meteorological commission.

Report 1905. Cape Town. 1906. xiv, 127 p. f°.

##### Ceylon. Surveyor general.

Meteorology [1905]. (Extr. Ceylon administration reports for 1905.) n. p. n. d. Fl-F44 p. f°.

##### Coester, A. and Gerland, E.

Beschreibung der Sammlung astronomischer, geodätischer und physikalischer Apparate im Königlichen Museum zu Cassel. Cassel. 1878. 48 p. 4°.

##### Courty, Fernand.

Climatologie du littoral Atlantique français... Paris. 1905. 14 p. 8°.

##### Defant, A. [Ibert].

Die Anhängigkeit der diffusen Wärmestrahlung von der Jahreszeit. (S.-A. Berichte Nat.-med. Innsbruck. 30. Jahrg. 1905-6.) Innsbruck. n. d.

##### Dörr, —.

Die Beobachtungsergebnisse der meteorologischen Stationen niedriger Ordnung im Herzogtum Braunschweig während des Zeitraumes 1878-1905. (S.-A. Beiträge Statist. Herz. Braunschweig. Heft 20. 1907.) 38 p. f°.

##### Egypt. Survey department.

Meteorological report for the year 1904. Part 1. Cairo. 1906. f°. Report on the work of the Survey department. 1905. Cairo. 1906. 76 p. 4°.

##### Guzman, David Y.

Apuntamientos sobre la topografía física de la República del Salvador. San Salvador. 1883. xix, [20]-535 p. 8°.

##### Hamburg. Deutsche Seewarte.

Deutsches meteorologisches Jahrbuch. Hamburg. 1906. vi, 192 p. f°.

##### Hann, J. [Julius].

Der tägliche Gang der Temperatur in der äusseren Tropenzone. A. Das amerikanische und afrikanische Tropengebiet. (Denkschr. Akad. Wien. 80. Bd.) Wien, 1907.

##### Huggard, W. R. and others.

Davos as health resort... Davos. 1906. iv, 316 p. 8°.

##### Hungary. Kgl. ung. Reichsanstalt für Meteorologie u. Erdmagnetismus.

Bericht über die Tätigkeit. 1905. Budapest. 1906. 30 p. 8°.

Jahrbuch. 34 Band. 1904. Thelle 1-3. Budapest. 1906. v. p. f°.

##### International meteorological committee.

Internationaler meteorologischer Kodex. Im Auftrage des Internationalen meteorologischen Komitees bearbeitet von G. Hellmann und H. H. Hildebrandsson. Deutsche Ausgabe besorgt von dem Königlich preussischen meteorologischen Institut. Berlin. 1907. viii, 81 p. 4°.

##### Juiz de Fora. Servicio meteorológico.

Boletim. 1906. n. p. n. d. f°.

##### Knoch, Karl.

Die Niederschlagsverhältnisse der Atlasländer. Frankfurt a. M. [1906.] 86 p. 8°.

##### Krakau. Observatory.

... Materyaly zbrane przez sekcyje meteorologiczne. [1905.] n. p. n. d. 73 p. 8°.

##### London. Solar physics observatory, South Kensington.

Report. 1906. n. p. n. d. 15 p. 8°.

##### Lutz, Karl Wolfgang.

Untersuchungen über atmosphärische Elektrizität mit besonderer Berücksichtigung ihrer technischen Bedeutung. [München. 1904.] 102 p. 4°.

##### Maugham, R. C. F.

Portuguese East Africa. New York. 1906. xii, 340 p. 8°.

##### Möller, M.

Flut und Witterung. Braunschweig. 1905. vi, 24 p. 8°.

##### Moscow. Agricultural institute. Meteorological observatory.

Observations. 1905. Moskva. 1907. xxx, 72 p. 4°.

##### Pastrana, Manuel E.

La sección meteorológica del estado de Yucatán. Mexico. 1906. 99 p. f°.

##### Prussia. Königliches preussisches meteorologisches Institut.

Ergebnisse der Beobachtungen an den Stationen II. and III. Ordnung im Jahre 1901... Berlin. 1906. xvi, 124-279 p. f°.

##### Rakhmanov, G.

Osnovy meteorologii. [Elements of meteorology.] (Russ.) Moskva. 1902. ii, 118 p. 8°.

##### Richter, Eugen.

Die Witterungskunde für den Haus-, Land- und Forstwirt. Regensburg. n. d. 30 p. 16°.

##### Rizzo, G. B.

Sopra il calcolo della profondità degli ipocentri nei movimenti sismici. (Estr. Accad. sc. Torino. v. 41. 17 giugno 1906.) Torino. 1906. 8p. 8°.

Sulla velocità di propagazione delle onde sismiche nel terremoto della Calabria del giorno 8 settembre 1905. (Estr. Mem. Accad. sc. Torino. Ser. II, Tom. 57. 17 giugno 1906.) Torino. 1906. p. [309]-350. f°.

##### Royal society of New South Wales.

Journal and proceedings. 1905. Sydney. 1905. v. p. 8°.

##### Rykachev, M.

Novyi isparitel dlia nablupenii nad ispareniiem travy i pervyia nabludeniiia po nem v Konstantinovskoi observatorii y 1896 g. [New evaporimeter for observing evaporation from the grass, and first observations with this instrument at the Constantine observatory in 1896.] St. Petersburg. 50 p. f°. (Mém. Acad. sc., St. Petersburg. 7 sér. Classe phys.-math. v. 7. No. 3.)

##### South Australia. Government astronomer.

Meteorological observations made at the Adelaide observatory and other places... 1902-3. Adelaide. 1905. xx, 65 p. f°.

- Steen, Aksel S.**  
Report of the Second Norwegian Arctic expedition in the *Fram*. 1898-1902. No. 6. Terrestrial magnetism. Kristiania. 1907. 82 p. 4°.
- Stöckigt, Willi.**  
Ueber den Einfluss der Lage die Temperaturentwicklung der Sommermonate und die Luftfeuchtigkeit an heissen Tagen im Schwarzwaldgebiet... Inaug.-Diss... Saalfeld. [Jena. 1906.] 72 p. 4°.
- Streit, A.**  
Das Wesen der Cyklonen. Wien. 1906. vi, 125 p. 8°.
- Thieme, F. W.**  
Neues und vollständiges Handwörterbuch der englischen und deutschen Sprache. 18. Auflage vollständig neu bearbeitet von Leon Kellnar. 2 Theile. Braunschweig. 1901-5. xlviii, 491; xlv, 597 p. 4°.
- Unanue, Hipolito.**  
Observaciones sobre el clima de Lima... Madrid. 1815. (26), 315 p. 8°.
- Walker, James.**  
The analytical theory of light. Cambridge. 1904. xv, 416 p. 4°.

## RECENT PAPERS BEARING ON METEOROLOGY.

H. H. KIMBALL, Librarian.

The subjoined titles have been selected from the contents of the periodicals and serials recently received in the Library of the Weather Bureau. The titles selected are of papers or other communications bearing on meteorology or cognate branches of science. This is not a complete index of the meteorological contents of all the journals from which it has been compiled; it shows only the articles that appear to the compiler likely to be of particular interest in connection with the work of the Weather Bureau. Unsigned articles are indicated by a —

- Bulletin of the American geographical society.* New York. v. 39. Apr., 1907.  
T., R. S. Calabrian earthquakes. p. 236-237.
- Bulletin of the geographical society of Philadelphia.* Philadelphia. v. 5. Apr., 1907.  
Bennett, Helen Christine. Kingston, the capital of Jamaica, as it was and is. p. 1-9. [Graphic description of the Kingston earthquake, January 15, 1907.]
- Smith, Philip S. Settlements and climate of the Seward Peninsula, Alaska. p. 10-20. [Climate of Nome and vicinity.]
- Nature.* London. v. 75.  
MacDowall, Alex. B. Rothesay rainfall and the sun-spot cycle. (Mch. 21, 1907.) p. 488.  
— The weather reports of the meteorological office. (Mch. 21, 1907.) p. 488-490.  
— The weather and the crops. (Apr. 4, 1907.) p. 545-546. [Abstract of paper by R. H. Hooker.]
- Physical Review.* Lancaster. v. 24. Mch., 1907.  
Turnbull, W. R. Researches on the forms and stability of aeroplanes. p. 285-302.
- Science.* New York. New Series. v. 25. Apr. 5, 1907.  
Wetherill, Henry Emerson. Some new and useful data in reference to the moisture of the air. [Abstract.] p. 523. [Notice of a cobalt hygroscope.]
- Gates, Fanny Cook. On the conductivity of the air caused by certain compounds during temperature changes. [Abstract.] p. 528.
- Barus, Carl. On distributions of nuclei and ions in dust-free air. [Abstract.] p. 534-535.
- Ward, R. DeCourcy. Cumulus clouds over the San Francisco fire. p. 554-555.
- Scientific American.* New York. v. 96.  
Rotch, A. Lawrence. The meteorological conditions above St. Louis. (Mch. 30, 1907.) p. 271.  
— A great jam on the Susquehanna River. (Apr. 6, 1907.) p. 288.
- Scottish geographical magazine.* Edinburgh. v. 23. Apr., 1907.  
Newbigin, I. The Swiss Valais: a study in regional geography. p. 169-191. [Climate, p. 175-183.]
- Symons's meteorological magazine.* London. v. 42. Mch., 1907.  
Innes, R. T. A. Rain gauge exposure in the Transvaal. p. 21-23.  
— The British weather reports. p. 23-27. [General description, with notes of changes recently introduced. Announces the inauguration of a monthly weather report.]
- Krebs, Wilhelm. Qualitative analysis of curve diagrams. p. 27-28.  
— Rain-making experiments in the Klondike. p. 29.
- Druce, F. Weather recording. p. 29-31.
- Clark, J. Edmund. A relation between rainfall at York and solar cycles. p. 32-33.
- Lander, A. The Lander self-recording rain gage. p. 37.
- Terrestrial magnetism and atmospheric electricity.* Baltimore. v. 11. Dec., 1906.

- Oddone, Emilio. Measurements of the electric potential during the total solar eclipse of August 30, 1905, at Tripoli, Barbary. p. 167-180.  
— Adam Paulsen (1833-1907). p. 198.
- Transactions of the royal society of Edinburgh.* Edinburgh. v. 41. Pt. 3. 1904-5.  
Chrystal, [George]. On the hydrodynamical theory of seiches. p. 599-649. [Bibliography, p. 644.]
- Annuaire de la Société météorologique de France.* Paris. 54 année.  
Dongier, R. Introduction à l'étude des phénomènes électriques de l'atmosphère. Radioactivité; ions; électrons. (Août 1906.) p. 213-230. [A popular résumé of recent theories of atmospheric electricity.]
- Cœurdevache, P. Variation annuelle de la nébulosité. (Août 1906.) p. 235.
- Dufour, Ch. Variation diurne de la pression barométrique à Rikitea. (Oct., 1906.) p. 253-257.
- Ouzilleau, —. Note sur le climat de Koury (Soudan Français). (Oct., 1906.) p. 257-261.
- Dufour, Ch. Températures extrêmes au sommet de la Tour Eiffel (1889-1906). (Oct., 1906.) p. 262-264.
- Moureaux, Th. Résumé de 23 années d'observations de l'insolation au Parc Saint-Maur. (Nov., 1906.) p. 269-274.
- Chauveau, A. B. Sur le typhon du 18 septembre à Hong-Kong. (Nov., 1906.) p. 274-276.
- Maillet, Edmond. Sur la durée de propagation des maxima des crues dans le bassin de la Seine. (Dec., 1906.) p. 285-288.
- Besson, L. Recherches expérimentales sur l'orientation des cristaux de glace atmosphériques. (Fév., 1907.) p. 40-50.
- Garrigou-Lagrange, P. Pluies, rivières et sources du Limousin. (Fév., 1907.) p. 50-52. [Relations of rainfall to stream flow; experiments under conditions very favorable for observation.]
- Bulletin de la Société belge d'astronomie.* Bruxelles. 12 année. Mars 1907.  
Boutquin, A. De l'emploi des appareils de télégraphie sans fil pour l'observation des courants atmosphériques dans les régions polaires. p. 79-86.
- Comptes rendus de l'Académie des sciences.* Paris. Tome 144. 18 mars 1907.  
Oddone, E. Sur quelques constantes sismiques déduites du tremblement de terre du 4 avril 1904. p. 662-664.
- Revue néphologique.* Mons. Mars 1907.  
Mémery, Henri. La lune "mange-t-elle" les nuages? p. 113-114. [Observations discrediting belief in the moon's effect on clouds.]
- B[racke], A. Les nuages de neige cosmiques. p. 114-115. [Review of work by C. Drescher.]
- Defant, A[ibert]. Dépendance de la radiation calorifique diffuse de l'époque de l'année. p. 117-120.
- Annalen der Hydrographie und maritimen Meteorologie.* Berlin. 35 Jahrgang. 1907.  
Knipping, E. Der Hongkong-Taifun vom 18 Dezember 1906. p. 97-102.
- S., v. Windverhältnisse in Mogadar, der Kamerun-Mündung und der Walfish-Bucht, mit besonderer Berücksichtigung der täglichen Schwankungen. p. 103-108.
- Kaiser, Max. Land- und Seewinde an der deutschen Ostseeküste. p. 113-122.
- K., E. Zwei Taifune im Golf von Tonkin am 20 und 24 September 1906. p. 136-137.
- Meteorologische Zeitschrift.* Braunschweig. Band 24. März 1907.  
Pernter, J[oseph] M[aria]. Das Ende des Wetterschliessens. p. 97-102.
- Ekholm, Nils. Ueber die unperiodischen Luftdruckschwankungen und einige damit zusammenhängende Erscheinungen. p. 102-113.
- Woeikow, A. Temperatur des Ural. - Der Juli und September 1906 in Russland. Das aerodynamische Institut bei Moskau. p. 114-119.
- Woeikow, A. Das Barometermaximum im Januar 1907. p. 120. [Highest pressure ever observed in western Russia.]
- H[ann], J[ulius]. Das ausserordentliche Barometermaximum. p. 121.
- E., F. M. Ueber die Theorie der Guilbertschen Regeln der Wettervorhersage von Bernard Brunhes (Arch. d. sciences phys. et. nat., 15 Juli 1906). p. 121-122. [Adverse criticism of Guilbert's rules and Brunhes's discussion of them.]
- Klima von Buitenzorg. p. 124-129.
- Ueber die Eisverhältnisse des Ryek unfern des Greifswalder Bodden. p. 129. [Record 1839-1870.]
- Schmidt, Ad. Vorläufige Mitteilung über magnetische Variationsbeobachtungen in einem Bergwerk. p. 130-131.
- Adam Paulsen. p. 138-139.
- Exner, Karl. Farbe und Polarisation des Himmelslichtes. p. 139. [An experiment showing color and polarization to be due to the molecules of the air itself.]
- Köppen, W. Klassifikation der Klimate. p. 140-142. [Replies to Prof. Ward's criticism of Köppen's classification.]
- Hann, J[ulius]. Temperatur von Bombay und Kalkutta. p. 142. [Corrects an error in Hann's Lehrbuch der Meteorologie.]

*Mitteilungen aus den deutschen Schutzgebieten. Berlin. 20 Band.*

Ottweiler, Emil. Die Niederschlags-Verhältnisse von Deutsch-Südwestafrika. p. 1-84. [A compilation of all available data, including chart of mean annual rainfall and bibliography.]

*Naturwissenschaftliche Rundschau. Berlin. 22 Jahrgang. 21 März 1907.*

Süring, R. Wilhelm von Bezold. p. 153-155.

*Neueste Erdbeben-Nachrichten. Laibach. Jahrgang 6. 1906-7.*

Belar, A. Bodenbewegungen und die Stabilität der Bauten. p. 81-85.

Falsche Erdbebennachrichten. p. 103-105.

*Sitzungsberichte der Königlich preussischen Akademie der Wissenschaften. Berlin. 1907. XII.*

Warburg, E. and Leithäuser, G. Ueber die Oxydation des Stickstoffs bei der Wirkung der stillen Entladung auf atmosphärische Luft. p. 229-234.

*Weltall (Das). Berlin. 7 Jahrgang. 1907, April 1.*

Linke, Felix. Vom Staube. p. 193-201.

Krebs, Wilhelm. Witterungsvoraussicht und Sonnentätigkeit. p. 201-203.

*Wetter (Das). Berlin. 24 Jahrgang. März 1907.*

Grohmann, —. Die Wettervorhersage auf den Witterungsberichten des Königl. sächsischen meteor. Institutes. p. 49-54.

Kaiser, Max. Historische Entwicklung unserer Kenntnis der Land- und Seewinde auf der Erde und Darstellung der gegenwärtigen Theorien. p. 54-65.

Wahlburg, Eduard Schiefer Edler von. Die Antizyklone der letzten Januar-Dekade 1907. p. 68-72.

*Atti della Reale accademia dei Lincei. Roma. v. 15. 1906.*

Monti, V. Sulla misura della velocità di propagazione delle perturbazioni sismiche in rapporto alla sismometria razionale. p. 15-18.

Pizzetti, —. Intorno al calcolo della rifrazione astronomica, senza speciali ipotesi sul modo di variare della temperatura dell'aria coll'altezza. p. 73-81.

Chella, Silvio. Misura del coefficiente di attrito interno dell'aria a basse temperature. p. 119-125.

Chistoni, Ciro. Risultati pireliometrici ottenuti dal 22 agosto a tutto giugno 1903 al R. Osservatorio geofisico di Modena. p. 126-132.

Monti, V. Sulla probabile origine della distribuzione dei temporali italiani a seconda delle stagioni. p. 173-175.

Chistoni, Ciro. Misure pireliometriche eseguite sul Monte Cimone nell'estate del 1902 e nell'estate del 1903. p. 208-213.

Teglio, Emilio. Contributo allo studio del pireliometro a compensazione elettrica dell'Angström. p. 214-216.

Monti, V. Sull'interpretazione matematica dei sismogrammi. p. 217-219.

Chistoni, Ciro. Misure pireliometriche eseguite sul Monte Cimone nell'estate del 1904 e nell'estate del 1905. p. 276-281.

Eredia, Filippo. La pioggia a Roma. p. 450-456. [Gives rainfall in extenso, by months, 1825-1906.]

Blaserna, —. Sulle esperienze degli spari contro la grandine, eseguite a Castelfranco Veneto negli anni 1902-1906. p. 680-682.

*Revista marittima. Roma. Anno 4. Marzo 1907.*

Penne, Renzo de la. Osservazioni di scariche elettriche dell'atmosfera. [Observations made aboard the *Calabria* in a voyage around the world.]

*Società geografica Italiana. Roma. Serie 4. Vol. 7.*

— La regione meno piovosa delle Alpi. (Feb., 1906.) p. 142-143.

— La rete meteorologica eritrea. (Feb., 1906.) p. 155.

Baratta, Mario. I terremoti di Calabria. (Maggio 1906.) p. 432-459.

Alessandri, Camillo. Due mesi sulla vetta del Monte Rosa. (Luglio 1906.) p. 639-662. [Account of Regina Margherita observatory, Monte Rosa.]

Tancredi, A. M. Nota sul clima del Serahè (Colonia Eritrea). (Dic. 1906.) p. 1192-1249. [Includes collected data for Adi-Ugri and Chenafena.]

Baratta, M. Sulla distribuzione topografica dei terremoti nel Chili. (Gen. 1907.) p. 30-37.

*Boletín de la Sociedad geográfica de Lima. Año 16. Tome 19.*

Victoria, Ernesto G. Evaporación y frío producido por ella en Lima. p. 1-58.

Castre, Emilio. El departamento de San Martín y nuestras regiones orientales. Conferencia dada en la Sociedad geográfica de Lima. p. 59-97. [Climate, p. 61-62.]

*Hemel en dampkring. Den Haag. 4. Jaargang.*

Kater, J. De groene straal bij op en ondergang der zon. p. 170-171.

M. Het fiebied van hooge drukking in de tweed helft van Januari dezes jaars. p. 171-173. [Includes charts Jan. 19-24.]

M. Weerkundige waarnemingen te de Bilt 1897-1906. p. 173-176. [Brief résumé 1897-1906.]

## NORTH ATLANTIC WEATHER.

By MR. JAMES PAGE, Chief of the Division of Ocean Meteorology.

[Compiled from the daily observations, at Greenwich mean noon, furnished by cooperating observers at sea.]

The distribution of pressure over the North Atlantic Ocean at the instant of Greenwich mean noon of March 1 and the attendant circulation of the winds is shown on Chart X. Pressure is above the average over Iceland, 29.80 inches, and a marked anticyclonic area covers the eastern portion of the ocean and the western shores of the Continent of Europe. The latter feature of the pressure remained practically constant thruout the entire month, the minimum barometric reading at Ponta Delgada, Azores, during the period March 1-30 being 30.18 inches, recorded March 25, consequent upon a northward recession of the center of the high to the British Isles. Over the latter upon the same date readings of 30.40 inches and upward were recorded.

As a result of this special distribution of pressure the northeast trades blew thruout the entire month without interruption, extending in a continuous belt from the latitude of Cape Finisterre to the Line. At the entrance to the Channel and westward along the transatlantic routes as far as the meridian of 20° the winds blew almost continuously from the southwest quadrant, and fair weather prevailed. Upon one day only, viz, March 16, did these winds attain gale force, the result of a cyclonic storm central at the time in the vicinity of the Faroes, where the recorded pressure upon the date mentioned was 29.00 inches.

Over the western half of the ocean variations of pressure succeeded one another with marked rapidity, and as a consequence severe weather was the rule. The high central over New England yielded March 2 and was succeeded March 3 by a shallow low which extended eastward to mid-ocean. Upon this date the transatlantic routes between the meridians of 60° W. and 35° W. were accordingly visited by westerly gales, without, however, any decided change in the barometer.

Pressure over Iceland fell from 29.50 inches on March 2 to 28.90 inches on March 5, with the result that vessels following the route north about Scotland experienced southwesterly gales of force 10 and 11 during this period.

On March 5 a feeble area of low pressure moved eastward across Hatteras and on March 6 was central with a well developed system of cyclonic winds in the neighborhood of 37° N., 66° W., the lowest recorded pressure being 29.30 inches. From this point it moved northeastward, developing into a hurricane during the early hours of March 7.

The distribution of pressure and the circulation of the winds at Greenwich mean noon of this date are shown on Chart XI, the storm at this hour being central in latitude 42° N., longitude 56° W. Of the large number of vessels which experienced the hurricane's severity, the *Pretoria*, (German S. S., Schröter, report by 3d officer Suppeln), appears to have most nearly approached the center. The vessel was bound from Hamburg to New York, and at Greenwich mean noon of March 6 found herself in latitude 41° 55' N., longitude 53° 20' W. The remarks of the observer from this time forward are as follows:

"At 2 p. m. of March 6 the wind went from west, 2, to the southward, and so continued until 3 a. m. of March 7, with heavy rain squalls; lightning and thunder covering the whole sky. The wind then shifted to WSW., force 11, and at 6 a. m. to W., force 12, with a heavy hail squall. The lowest barometer, 725.0 millimeters (28.54 inches), occurred at 2 a. m., the position at the time being latitude 41° 51' N., longitude 57° 00' W., and the wind south, force 11."

The *Brandenburg*, (German S. S., Woltersdorff, Bremen to New York, report by officer Jaehnigen), also found herself within dangerous proximity to the storm center, altho in the

opposite semicircle. The position of the vessel at Greenwich mean noon of March 6 was latitude  $41^{\circ} 19' N.$ , longitude  $57^{\circ} 51' W.$ —about 180 miles, therefore, to the westward of the Pretoria. The shifts of the wind during the advance of the storm were ENE., 10; NNW., 11; WNW., 10. The observer reports: "Continuous violent rain until 2 p. m. of the 6th; a tremendous sea running, causing the ship to labor fearfully; the wind blows at times with hurricane force; at 6 p. m. the sea was so very boisterous that the ship had no steerage way; both engines were accordingly stopt; at 3 a. m. of March 7, the storm had abated sufficiently to allow us to resume our course; lowest barometer, 733 millimeters (28.88 inches), at midnight".

The center of the storm moved northward across Cape Race during March 8, and conditions were thence undisturbed until March 11. Upon this date another depression appeared in the neighborhood of  $39^{\circ} N.$ ,  $65^{\circ} W.$ , and, moving northeastward, was followed by northwesterly gales in the region to the southward of Nova Scotia. This was followed by a period of quiet weather which terminated on the 19th. Upon the last-named date a low moved eastward from the Great Lakes and on March 20 was central over the Bay of Fundy, the barometer at Eastport, Me., reading at 8 a. m. 28.66 inches. Southerly gales of force 10 and 11 swept the transatlantic routes from the American coast to the meridian of  $60^{\circ}$  west. The center of the depression did not at any time come within the region of observation at sea.

On March 24 an elongated trough of low pressure extended southeastward from Cape Race to a point situated in latitude  $35^{\circ} N.$ , longitude  $40^{\circ} W.$  On the western slope of this trough northwesterly gales of force 8 to 9 prevailed, covering a belt

300 miles in width. On the eastern slope southerly and southeasterly winds of force 6 were the rule, rising to force 8 thruout a limited area at the southern extremity. As the day advanced the axis of this trough assumed a more easterly direction, the trough itself at the same time increasing in depth, with the result that thruout March 25 the transatlantic routes from the longitude of Cape Race to the meridian of  $30^{\circ} W.$ , were the scene of steady southwesterly and westerly gales of force 9 and 10.

On the 26th of the month a tropical depression made its appearance between Bermuda and Porto Rico, in which the *Epsom* (British S. S., Cox, Channel to Galveston, report by officer Williams) and the *Tampico* (British S. S., Westcott, Channel to New Orleans, report by officer Haworth) became involved on the 27th. According to the report of the former vessel the slow initial fall of the barometer which marks the approach of storms of this nature set in at noon of March 25. At 4 a. m. of the 26th, the barometer rose slightly and the wind became variable, finally settling in the northeast, while a heavy northwesterly swell at the same time made itself felt. The position of the vessel at Greenwich mean noon was latitude  $33^{\circ} N.$ , longitude  $69^{\circ} W.$ ; wind NE., barometer 29.44 inches. Fifteen minutes later a squall of wind heralded the break of the threatening gale from the north. Fierce squalls of hurricane force were frequent and a very high and dangerous sea soon rose. The hurricane continued to rage thruout the day, the barometer meanwhile rising, altho very slowly. At Greenwich mean noon of the 27th the position of the *Epsom* was latitude  $30^{\circ} 30' N.$ , longitude  $63^{\circ} 10' W.$ , wind N., 12; barometer 29.71 inches, weather overcast and squally. At 1 p. m. the sky cleared and the wind and sea soon moderated.

### THE WEATHER OF THE MONTH.

By MR. P. C. DAY, Assistant Chief, Division of Meteorological Records.

#### PRESSURE.

The distribution of mean atmospheric pressure for March 1907, over the United States and Canada is graphically shown on Chart VI, and the average values and departures from the normal are shown for each station in Tables I and V.

During March, 1907, the distribution of the average pressure showed two well marked variations from the normal. Pressure averaged unusually low over all northwestern districts of the United States and Canada, and relatively high over all southern and eastern districts.

As a result of this reversal of pressure distribution, no high-pressure areas of any considerable magnitude moved southward from their usual source of origin over the Great Plains region east of the Canadian Rockies, and such cold waves as overspread the more northern districts were correspondingly lacking in severity.

On the other hand, the presence of unusually high pressure over the Gulf of California and adjacent territory and all southern and eastern districts forced the warm southerly winds of those latitudes far to the north of their usual limits.

Over the upper Missouri Valley and thence westward to the Pacific and northward over the Canadian Provinces the pressure was almost continuously below the average, while over southern California, Arizona, and New Mexico comparatively high pressure was the rule during most of the month.

Pressure also averaged considerably above the normal in all districts along the Gulf and Atlantic coasts. The entire region west of the Rocky Mountains, the Great Plains south of Nebraska, the lower Mississippi Valley, and the Gulf States were not within the direct influence of any considerable area of high pressure, having its origin in northern districts, during the month; on the other hand, no portion of the country was exempt from the influence of the numerous low areas which moved eastward from the Pacific.

#### TEMPERATURE.

The warm waves that overspread nearly all districts of the United States east of the Rocky Mountains from the 18th to 23d and from the 24th to 29th established new records at many points for both the highest monthly mean and the highest maximum temperatures ever recorded in March at the respective stations.

The abnormally warm weather during the above periods occurred in connection with marked depressions of the barometer in the central districts, but generally without the usual cloud formations and attended by little or no precipitation, which, with comparatively high pressure over the Gulf States and in the extreme Southwest, gave warm southerly winds and almost midsummer temperatures over the Great Plains, central valleys, and all eastern districts. Maximum temperatures far in excess of any previous March record, and in some sections higher than before recorded in any previous April or May, were recorded about the 23d, and again about the 29th.

The month as a whole was one of marked temperature excess over all portions of the United States, except the extreme eastern portion of Maine and over the Pacific coast districts.

Over practically all that portion of the United States from the Rocky Mountains eastward the average for the month exceeded the normal by more than  $6^{\circ}$  daily, and over the greater portion of the central Mississippi Valley region, Kansas, Oklahoma, and Texas the normal was exceeded by more than  $10^{\circ}$  daily.

Over the greater portion of the territory between the Rocky Mountains and the Mississippi Valley and south of Nebraska, the temperature has averaged continuously above the normal for the four months from December to March, inclusive. The average excess during that period over portions of Kansas, Oklahoma, Texas, Louisiana, and Arkansas, ranges from  $7^{\circ}$  to more than  $10^{\circ}$  daily.

West of the Sierras the month averaged somewhat colder than normal, the average deficiency in the Sacramento Valley ranging from 3° to 5° daily.

Maximum temperatures above 90° were recorded in the south Atlantic and east Gulf districts, over the districts between the Mississippi River and the Rocky Mountains and south of Nebraska and Iowa, and over the southern portions of New Mexico, Arizona, and California.

Temperatures below zero were confined to the northern districts of New England, central and northern New York, the upper Missouri Valley, and in the mountain districts of Wyoming and Colorado.

Freezing temperature did not penetrate farther south than to north-central Texas and the extreme northern portions of the Gulf States.

#### PRECIPITATION.

The deficiency in precipitation over portions of the South Atlantic and east Gulf States, and the Florida Peninsula, noted in the REVIEW for February, 1907, continued during March.

Over all the States of the cotton belt the precipitation was from 2 to 4 inches less than the average fall, and in portions of those States the amounts measured were the least on record.

Over the Florida Peninsula the accumulated deficiency from September, 1903, to March, 1907, inclusive, amounted to about 13 inches. Less than the average amounts of precipitation occurred over all districts along the Atlantic coast, in the districts between the Mississippi Valley and the Rocky Mountains, and over most of Washington and northwestern Oregon.

In the watershed of the Ohio River heavy precipitation occurred from the 12th to 14th, which, with the rapid melting of the snow on the ground, combined to produce one of the worst floods in the history of the streams of that section, a full account of which appears elsewhere in this issue.

Over all portions of the mountain and Plateau districts of the west and the Pacific coast from Washington southward, the precipitation was generally above the average. In the mountainous portions of California and generally over the State the month was one of the wettest on record. Rain or snow occurred in some portion of the State nearly every day of the month, and the daily and monthly amounts recorded at some of the elevated stations on the western flanks of the Sierras were phenomenal.

Monthly amounts from 30 to more than 45 inches were measured at numerous points, with daily falls of from 5 to as much as 8 inches.

The unusually heavy falls of rain and snow filled the rivers and streams of that State, and the stages at many places were the highest on record.

#### SNOWFALL.

The snowfall during March was generally light on the eastern slopes of the Rocky Mountains and thence eastward, except over the mountain portions of West Virginia, Maryland, and southern Pennsylvania, where considerable snow occurred about the 10th. On the western slopes of the Rocky Mountains, over the Plateau region, and on the elevated portions of California and Oregon the snowfall was generally above the average.

In the mountains of California the monthly amounts were exceptionally heavy, the total fall at some of the higher elevations amounting to as much as 25 feet. In the mountains of Idaho and in Montana west of the main range, and on the western slopes of the mountains of Wyoming and Colorado much snow occurred. The warm weather, with strong southerly winds, melted much from the lower elevations, but in the wooded districts and other protected localities much snow had accumulated.

Owing to the alternate thawing and freezing, together with the considerable rain that had fallen upon the snow, it had become thoroly packed, contained a large percentage of water

and was in excellent condition, supplemented by the generally well-saturated condition of the soil, to assure more than an average supply of water in the streams till late in the summer.

At the end of the month snow still covered the ground in the woods of northern New England and the Upper Peninsula of Michigan. From the Great Lakes westward the southern limit of snow receded during the month to the extreme northern portions of the States, where depths of a few inches still remained on the ground. Much snow still remained unmelted in the mountains west of the Continental Divide.

#### HUMIDITY AND SUNSHINE.

Over all interior districts east of the Rocky Mountains the percentage of relative humidity averaged considerably lower than the normal. On the immediate Gulf coast and the Florida Peninsula, despite the lack of precipitation, the amount of moisture in the atmosphere averaged considerably above the normal, owing to the influence of the prevailing moist southerly winds from the Gulf. In all districts west of the Rocky Mountains the relative humidity was unusually high.

Much bright sunshiny weather prevailed in all districts east of the Rocky Mountains, especially over the Great Plains, Mississippi Valley, and Gulf States, where the progress of the season averaged from two to four weeks in advance of the normal, both in the development of vegetation and in the opportunities offered for the prosecution of the usual seasonal operations.

On the Pacific slope, especially over California and Oregon, cold, rainy weather during most of the month retarded the development of vegetation, and delayed the prosecution of all outdoor occupations.

#### Average precipitation and departures from the normal.

Districts.	Number of stations.	Average.		Departure.	
		Current month.	Percent- age of normal.	Current month.	Accumulated since Jan. 1.
		Inches.		Inches.	Inches.
New England.....	12	2.42	67	-1.2	-3.3
Middle Atlantic.....	16	2.81	74	-1.0	-3.5
South Atlantic.....	10	1.57	36	-2.8	-7.4
Florida Peninsula*.....	8	0.29	9	-2.8	-7.5
East Gulf.....	11	2.04	35	-3.8	-6.3
West Gulf.....	10	1.83	57	-1.4	-4.0
Ohio Valley and Tennessee.....	13	4.82	112	+0.5	0.0
Lower Lake.....	10	2.84	112	+0.3	-0.1
Upper Lake.....	12	2.24	110	+0.2	-0.6
North Dakota*.....	9	0.85	89	-0.1	+0.3
Upper Mississippi Valley.....	15	2.28	100	0.0	+0.6
Missouri Valley.....	12	1.04	60	-0.7	+0.3
Northern Slope.....	9	0.54	64	-0.3	-0.2
Middle Slope.....	6	0.58	45	-0.7	-0.6
Southern Slope*.....	7	0.59	60	-0.4	-0.6
Southern Plateau*.....	12	1.49	167	+0.6	+1.2
Middle Plateau*.....	10	1.88	147	+0.6	+0.9
Northern Plateau*.....	12	1.80	120	+0.3	+0.8
North Pacific.....	7	3.45	66	-1.8	-4.2
Middle Pacific.....	8	8.00	209	+4.0	+4.9
South Pacific.....	4	3.57	165	+1.4	+3.0

\* Regular Weather Bureau and selected cooperative stations.

#### In Canada.—Director Stupart says:

The precipitation was deficient thruout the greater portion of the Dominion, the exceptions to the prevailing conditions being a marked positive departure in the vicinities of Calgary and Prince Albert, a slight excess in portions of northwestern Manitoba, an excessive amount of snow in the neighborhood of White River, Ont., and a positive departure locally in the precipitation of about one inch in the Georgian Bay region and also in the extreme western portion of Quebec. In the Maritime Provinces, altho several heavy snowstorms occurred, the precipitation was everywhere below the usual amount. The chief negative departures reported were New Westminster, 3.6 inches; Kingston, 1.7 inches; Yarmouth, 2.6 inches; Halifax and St. John, 2.1 inches. The principal positive departures were Prince Albert, -1.0 inch; White River, 2.8 inches; Parry Sound, 1.4 inches; Southampton, 0.9 inch; Montreal, 1.0 inch.

In the southern portions of British Columbia, the extreme southwest- ern portion of the Maritime Provinces, and in the Peninsula of Ontario the ground was generally bare of snow at the close of the month, but over a large portion of the Dominion there was still a considerable cover-

ing. Cariboo reports as much as 68 inches on the lower levels and far greater depths on the mountains; Alberta, from a trace in southern localities to 9 inches in northern; Saskatchewan, from 4 to 10 inches; Manitoba, from a trace to 8 inches; the northern portions of Ontario, from 2 to 9 inches; Quebec, from 6 to over 24 inches; and the Maritime Provinces as much as 24 inches in northern districts.

*Average temperatures and departures from the normal.*

Districts	Number of stations.	Average temperatures for the current month.	Departures for the current month.	Accumulated departures since January 1.	Average departures since January 1.
New England	12	34.6	+ 1.5	- 6.7	- 2.2
Middle Atlantic	16	45.0	+ 4.7	+ 1.9	+ 0.6
South Atlantic	10	61.1	+ 7.2	+ 11.4	+ 3.8
Florida Peninsula*	8	72.0	+ 5.7	+ 10.6	+ 3.5
East Gulf	11	66.7	+ 9.4	+ 19.3	+ 6.4
West Gulf	10	66.8	+ 9.5	+ 22.7	+ 7.6
Ohio Valley and Tennessee	13	53.1	+ 8.8	+ 13.0	+ 4.3
Lower Lake	10	37.6	+ 8.3	+ 1.6	+ 0.5
Upper Lake	12	32.6	+ 5.3	+ 3.9	+ 1.3
North Dakota*	9	25.0	+ 5.0	- 1.5	- 0.5
Upper Mississippi Valley	13	44.0	+ 7.9	+ 11.8	+ 3.9
Missouri Valley	12	45.6	+ 9.6	+ 13.7	+ 4.6
Northern Slope	9	35.3	+ 4.5	+ 5.0	+ 1.7
Middle Slope	6	52.0	+ 9.5	+ 19.6	+ 6.5
Southern Slope*	7	60.4	+ 9.7	+ 24.3	+ 8.1
Southern Plateau*	12	59.3	+ 1.2	+ 11.0	+ 3.7
Middle Plateau	10	40.8	+ 2.6	+ 16.2	+ 5.4
Northern Plateau*	12	38.5	+ 0.9	+ 2.0	- 0.7
North Pacific	7	42.8	- 1.4	- 2.4	- 0.8
Middle Pacific	8	49.6	- 2.9	+ 0.2	+ 0.1
South Pacific	4	54.4	- 0.8	+ 3.6	+ 1.2

\* Regular Weather Bureau and selected cooperative stations.

*In Canada.—Director R. F. Stupart says:*

The temperature was below the average in British Columbia and Alberta, average or slightly below in Saskatchewan, except in the extreme eastern portion, average or a little below in eastern Quebec, and below the average in the Maritime Provinces; elsewhere in the Dominion it was above the average. The chief negative departures occurred in the northern portions of British Columbia and Alberta and in Prince Edward Island and Cape Breton, and amounted to from 4° to 5°. The most marked positive departures were in Manitoba, from 4° to 5°, and the greater portion of Ontario, from 4° to 8°.

*Average relative humidity and departures from the normal.*

Districts	Average.	Departure from the normal.	Districts	Average.	Departure from the normal.
New England	73	- 2	Missouri Valley	68	- 4
Middle Atlantic	70	- 2	Northern Slope	68	+ 1
South Atlantic	72	- 3	Middle Slope	56	- 4
Florida Peninsula	80	+ 3	Southern Slope	50	- 1
East Gulf	72	- 1	Southern Plateau	47	+ 8
West Gulf	74	+ 2	Middle Plateau	62	+ 5
Ohio Valley and Tennessee	69	- 2	Northern Plateau	71	+ 4
Lower Lake	77	+ 1	North Pacific	77	+ 1
Upper Lake	78	- 1	Middle Pacific	80	+ 4
North Dakota	81	- 3	South Pacific	74	+ 3
Upper Mississippi Valley	74	+ 1			

*Average cloudiness and departures from the normal.*

Districts	Average.	Departure from the normal.	Districts	Average.	Departure from the normal.
New England	5.4	- 0.2	Missouri Valley	5.6	0.0
Middle Atlantic	5.6	+ 0.1	Northern Slope	5.6	+ 0.3
South Atlantic	4.4	- 0.3	Middle Slope	4.8	+ 0.4
Florida Peninsula	2.3	- 1.7	Southern Slope	4.0	+ 0.3
East Gulf	4.4	- 0.3	Southern Plateau	4.0	+ 0.4
West Gulf	4.8	- 0.4	Middle Plateau	6.2	+ 1.7
Ohio Valley and Tennessee	6.0	+ 0.1	Northern Plateau	7.4	+ 0.6
Lower Lake	6.9	+ 0.5	North Pacific	6.5	- 0.1
Upper Lake	6.4	+ 0.5	Middle Pacific	8.8	+ 1.8
North Dakota	5.4	- 0.1	South Pacific	5.8	+ 1.3
Upper Mississippi Valley	5.8	+ 0.3			

*Maximum wind velocities.*

Stations	Date.	Velocity.	Direction.	Stations	Date.	Velocity.	Direction.
Alpena, Mich.	19	50	nw.	Mount Weather, Va.	8	50	nw.
Amarillo, Tex.	25	52	se.	Do	20	66	nw.
Bismarck, N. Dak.	21	76	w.	Nantucket, Mass.	24	56	ne.
Block Island, R. I.	20	67	nw.	New York, N. Y.	20	58	nw.
Do	25	50	ne.	Northfield, Vt.	20	50	nw.
Boston, Mass.	20	52	nw.	North Head, Wash.	21	56	se.
Buffalo, N. Y.	3	72	sw.	Do	22	74	se.
Do	5	58	nw.	Do	23	64	nw.
Do	17	50	sw.	Pierre, S. Dak.	21	62	sw.
Burlington, Vt.	16	81	se.	Pittsburg, Pa.	2	54	nw.
Do	19	50	se.	Do	8	50	nw.
Canton, N. Y.	17	64	sw.	Point Reyes Light, Cal.	5	72	se.
Cape Henry, Va.	14	56	n.	Do	9	60	sw.
Cleveland, Ohio	5	68	w.	Do	11	59	nw.
Columbus, Ohio	1	82	nw.	Do	12	82	nw.
Do	2	53	w.	Do	17	57	se.
Duluth, Minn.	5	50	w.	Do	18	55	se.
Do	19	56	nw.	Do	19	54	se.
Eastport, Maine	26	52	ne.	Do	22	82	se.
Escanaba, Mich.	20	56	nw.	Do	23	84	se.
Galveston, Tex.	19	55	nw.	Do	24	62	sw.
Grand Rapids, Mich.	30	52	ne.	Do	27	53	nw.
Hatteras, N. C.	29	50	sw.	Do	31	52	nw.
Do	24	50	ne.	Portland, Maine	29	54	nw.
Do	25	54	ne.	Pueblo, Colo.	26	61	w.
Lexington, Ky.	1	87	nw.	Rapid City, S. Dak.	21	60	sw.
Marquette, Mich.	19	56	nw.	Sault Ste. Marie, Mich.	19	61	nw.
Modena, Utah	20	52	sw.	Southeast Farallon, Cal.	5	64	se.
Do	24	50	sw.	Do	22	58	se.
Do	25	50	sw.	Do	23	60	se.
Mount Tamalpais, Cal.	5	53	s.	Syracuse, N. Y.	19	62	se.
Do	17	56	s.	Do	20	54	w.
Do	24	50	sw.	Do	24	66	se.
Mount Weather, Va.	2	56	nw.	Tatoosh Island, Wash.	23	60	se.
Do	3	62	nw.	Toledo, Ohio	5	54	w.
Do	6	62	nw.	Do	29	55	sw.

## CLIMATOLOGICAL SUMMARY.

By Mr. JAMES BERRY, Chief of the Climatological Division.

## TEMPERATURE AND PRECIPITATION BY SECTIONS, MARCH, 1907.

In the following table are given, for the various sections of the Climatological Service of the Weather Bureau, the average temperature and rainfall, the stations reporting the highest and lowest temperatures with dates of occurrence, the stations reporting greatest and least monthly precipitation, and other data, as indicated by the several headings.

The mean temperatures for each section, the highest and

lowest temperatures, the average precipitation, and the greatest and least monthly amounts are found by using all trustworthy records available.

The mean departures from normal temperature and precipitation are based only on records from stations that have ten or more years of observation. Of course the number of such records is smaller than the total number of stations.

Section.	Temperature—in degrees Fahrenheit.						Precipitation—in inches and hundredths.							
	Section average.	Departure from the normal.	Monthly extremes.				Section average.	Departure from the normal.	Greatest monthly.		Least monthly.			
			Station.	Highest.	Date.	Station.			Lowest.	Date.	Station.	Amount.	Station.	Amount.
Alabama.....	64.5	+ 8.8	6 stations.....	93	21, 29	Riverton.....	29	14	2.94	-2.82	Demopolis.....	4.88	Alaga.....	0.59
Arizona.....	55.1	+ 0.8	Astec.....	105	20	3 stations.....	103	3 dates	1.04	+0.04	Natural Bridge.....	3.17	3 stations.....	0.60
Arkansas.....	61.9	+ 9.7	Fayetteville.....	96	21	Harrison, Pond.....	25	2	3.22	-1.81	Helena No. 2.....	9.02	Heber.....	0.90
California.....	49.0	- 2.3	Mammoth Tank.....	104	28	Tamarack.....	8	28	10.67	+6.37	Inskip.....	45.30	Mammoth Tank.....	0.40
Colorado.....	40.7	+ 7.6	Holly.....	96	19	Antelope Springs.....	20	1	0.81	-0.60	Corona.....	4.22	6 stations.....	0.00
Florida.....	71.0	+ 5.6	3 stations.....	98	4 dates	Molino.....	37	4	0.62	-2.82	DeFuniak Springs.....	2.92	6 stations.....	0.00
Georgia.....	64.4	+ 8.0	Brunswick.....	99	23	Clayton.....	32	167	1.87	-3.31	Diamond.....	4.10	Waynesboro.....	0.16
Hawaii.....	68.6†	.....	Hauula, Oahu.....	87	13	Greenbush.....	32	64	.....	.....	Hakalau (Maui), Hawaii.....	37.27	Raymond Ranch, Maui.....	0.00
Idaho.....	38.1	+ 2.7	Garnet, Hot Spring.....	75	31	Kau, Hawaii.....	50	207	9.55†	.....	Landore.....	7.66	Salmon.....	0.92
Illinois.....	47.9	+ 8.3	Carrollton.....	94	22	Waihiawa, Oahu.....	50	134	.....	.....	La Harpe.....	6.40	Zion.....	0.77
Indiana.....	48.3	+ 9.0	Jeffersonville.....	90	21, 22	Lake.....	2	2	3.38	+0.90	Butlerville.....	9.46	Seymour.....	2.02
Iowa.....	40.6	+ 7.6	Clarinda, Massena.....	92	25	4 stations.....	15	6, 11	3.11	-0.27	Keokuk.....	5.05	Washita.....	0.23
Kansas.....	52.5	+10.2	Cimarron.....	100	19†	Angola.....	12	4†	4.90	+0.95	Paola.....	3.32	2 stations.....	T.
Kentucky.....	54.9	+ 7.9	Englewood.....	100	21†	Rensselaer.....	12	11†	.....	.....	Scott.....	6.86	Bowling Green.....	2.66
Louisiana.....	69.5	+ 9.2	Shelbyville.....	92	21†	Inwood.....	7	2	1.35	-0.55	Ruston.....	7.25	Lafayette.....	0.39
Maryland and Delaware.....	46.1	+ 4.1	Opelousas.....	95	25	Harrison.....	5	1†	1.12	-0.44	Grantsville, Md.....	7.50	Ocean City, Md.....	1.88
Michigan.....	34.6	+ 5.5	Salisbury, Md.....	93	24†	Republic.....	5	1†	.....	.....	Cassopolis.....	6.00	Blanney.....	0.55
Minnesota.....	28.7	+ 3.3	Harbert.....	85	21, 26†	Williamsburg.....	18	9	2.88	-1.17	Wabasha.....	2.47	Pipestone.....	0.10
Mississippi.....	66.0	+ 9.1	Winnebago.....	84	26	Plain Dealing.....	32	2	2.12	-3.02	Merrill.....	9.98	Walnut Grove.....	0.88
Missouri.....	53.9	+10.6	Clarksdale.....	93	26	Oakland, Md.....	2	7	3.26	-0.43	Mount Vernon.....	5.68	Oregon.....	1.15
Montana.....	31.1	+ 2.9	Belle.....	95	21	Humboldt.....	-24	6	2.60	+0.34	Snowshoe.....	6.74	Fallon.....	T.
Nebraska.....	43.4	+ 8.2	Graham.....	78	18†	Plentywood.....	-25	6	1.26	+0.14	Fort Robinson.....	1.90	Osceola.....	0.00
Nevada.....	38.3	- 0.3	Lamedeer.....	78	20†	Agate.....	-10	1	0.44	-0.70	Lowers Ranch.....	16.83	Tegoma.....	0.03
New England*.....	32.7	+ 1.9	Superior.....	101	21	Halleck.....	-10	26†	2.66	+1.26	Nantucket, Mass.....	4.62	Cornwall, Vt.....	0.37
New Jersey.....	41.2	+ 2.2	Logan.....	83	31	Hamilton.....	-10	26†	.....	.....	Englewood.....	4.38	Pleasantville.....	1.81
New Mexico.....	49.5	+ 5.0	Torrington, Conn.....	84	30	Van Buren, Me.....	-32	1	2.04	-1.86	Cloudercroft.....	1.50	21 stations.....	0.00
New York.....	34.6	+ 3.3	Beverly.....	88	29	River Vale.....	-11	7	3.04	-1.10	Middletown.....	3.93	Coeymans.....	0.40
North Carolina.....	55.7	+ 5.5	Carlsbad.....	97	20	Chama.....	0	1	0.19	-0.51	Eagletown.....	5.68	Southport.....	0.67
North Dakota.....	23.1	+ 4.8	3 stations.....	84	3 dates	Faust.....	-20	1†	1.90	-1.25	Gladys.....	3.25	2 stations.....	T.
Ohio.....	43.9	+ 7.1	Southern Pines.....	100	29	New Lisbon.....	-20	7†	.....	.....	Camp Dennison.....	9.17	Toledo No. 2.....	2.43
Oklahoma and Indian Territories.....	60.2	+ 9.7	Berthold Agency.....	83	21	Buck Spring.....	16	6	2.88	-2.02	Calvin, Ind. T.....	4.08	Beaver, Okla.....	0.60
Oregon.....	41.6	- 0.6	Portsmouth.....	96	23	Langdon, Pembina.....	-20	1	0.70	-0.22	Buckhorn Farm.....	14.23	Richland.....	0.65
Pennsylvania.....	41.8	+ 4.7	Arapaho, Okla.....	103	19†	Rome.....	-2	4	5.55	+2.16	Lock No. 4.....	8.20	Pocono Lake.....	1.08
Porto Rico.....	71.7	.....	Erick, Okla.....	103	19†	Kenton, Okla.....	13	1	1.44	-1.00	Barros.....	4.58	2 stations.....	0.00
South Carolina.....	62.0	+ 7.7	Grants Pass.....	75	30	Government Camp.....	0	4	4.30	-0.26	Clemson College.....	3.02	Blackville.....	0.59
South Dakota.....	36.1	+ 7.5	Everett.....	92	24	Pocono Lake.....	-10	7	4.26	+0.37	Leola.....	2.50	3 stations.....	T.
Tennessee.....	55.9	+ 9.7	Central Aguirre.....	94	10	Cayey.....	46	30	1.85	.....	Walling.....	7.84	Elizabethton.....	2.72
Texas.....	67.3	+ 9.8	Blackville, Darling- ton.....	99	23	Greenville.....	20	4	1.57	-2.30	Longview.....	4.10	7 stations.....	0.00
Utah.....	42.4	+ 4.4	Franklin.....	93	21	White Horse.....	-17	1	0.46	-0.84	Huntsville.....	4.08	2 stations.....	0.00
Virginia.....	50.7	+ 5.6	Wellington.....	87	23	Erasmus.....	21	4	4.43	-1.33	Big Stone Gap (a).....	5.21	Nokesville.....	1.02
Washington.....	40.4	- 0.8	Arvonis.....	96	29	Pinto.....	-2	28	1.65	+0.15	Clearwater.....	11.77	Ephrata.....	0.07
West Virginia.....	49.6	+ 7.1	Mottlinger's Ranch.....	76	31	Burkes Garden.....	15	6	3.19	-0.85	Moundsville.....	8.18	Moorfield.....	1.05
Wisconsin.....	33.5	+ 4.8	Romney.....	94	29†	Twisp.....	8	4	2.65	-0.71	Valley Junction.....	3.19	Medford.....	0.60
Wyoming.....	34.1	+ 6.6	Weston.....	94	23†	Bayard.....	2	7	4.77	+0.33	Lake Yellowstone, } Yellowstone N. Pk. }	7.48	Buffalo.....	0.07
			Prairie du Chien.....	85	26	Koepenick.....	-16	6†	1.68	-0.30				
			Pine Bluff.....	86	20	Prentice.....	-16	6†	1.65	-0.03				
						Daniel.....	-16	27†	.....	.....				
						Wells.....	-16	15†	.....	.....				

\* Maine, New Hampshire, Vermont, Massachusetts, Rhode Island, and Connecticut.

† 48 stations, with an average elevation of 533 feet.

‡ 143 stations.

## DESCRIPTION OF TABLES AND CHARTS.

By Mr. P. C. DAY, Assistant Chief, Division of Meteorological Records.

For description of tables and charts see page 30 of REVIEW for January, 1907.

TABLE I.—Climatological data for U. S. Weather Bureau stations, March, 1907.

Stations.	Elevation of instruments.			Pressure, in inches.			Temperature of the air, in degrees Fahrenheit.										Precipitation, in inches.			Wind.				Clear days.	Partly cloudy days.	Cloudy days.	Average cloudiness during daylight, tenths.	Total snowfall.	
	Barometer above sea level, feet.	Thermometers above ground.	Anemometer above ground.	Actual, reduced to mean of 24 hours.	Sea level, reduced to mean of 24 hrs.	Departure from normal.	Mean max. + min. + 2.	Departure from normal.	Maximum.	Date.	Mean minimum.	Date.	Greatest daily range.	Mean wet thermometer.	Mean temperature of the dew-point.	Mean relative humidity, per cent.	Total.	Departure from normal.	Days with .01, or more.	Total movement, miles.	Prevailing direction.	Miles per hour.	Direction.						Date.
New England.																													
Eastport.....	76 69	85	29.92	30.00	+	.07	34.6	+ 1.5	49	29 34	0	1	22	24	26	22	73	2.42	- 1.2	9	8,935	sw.	56	nw.	20	8	11	12	5.4
Portland, Me.....	103 81	117	29.92	30.05	+	.09	32.2	+ 0.2	64	30 39	5	1	25	27	28	22	66	2.58	- 0.8	9	6,704	nw.	54	nw.	20	11	6	14	5.6
Concord.....	288 70	79	29.73	30.06	+	.06	32.7	+ 0.2	69	29 42	- 3	1	24	34	34	22	73	0.99	- 2.5	7	4,291	nw.	42	nw.	20	13	8	10	4.6
Burlington.....	404 12	47	29.60	30.06	+	.06	30.6	+ 0.9	65	30 40	- 9	1	22	37	37	22	73	1.87	- 0.7	10	9,758	se.	52	se.	17	9	11	11	5.8
Northfield.....	876 16	70	29.08	30.06	+	.06	28.5	+ 2.3	63	22 39	- 15	1	18	40	25	22	73	1.87	- 1.0	11	6,830	se.	50	se.	20	10	10	11	5.8
Boston.....	125 115	188	29.91	30.05	+	.08	37.9	+ 2.9	71	30 45	14	1	30	27	34	28	69	1.66	- 2.4	12	8,048	nw.	52	nw.	20	11	6	14	5.5
Nantucket.....	12 14	90	30.02	30.03	+	.05	37.1	+ 0.3	68	29 43	21	7	31	27	34	30	81	4.62	+ 1.1	15	12,598	sw.	56	ne.	24	9	11	11	5.5
Block Island.....	26 11	46	30.03	30.06	+	.08	36.4	+ 0.5	68	29 42	19	7	31	27	33	30	81	2.80	- 1.2	15	13,114	sw.	57	nw.	20	11	9	11	5.5
Narragansett.....	9	9	30.06	30.06	+	.08	37.2	+ 2.2	76	30 46	13	9	28	38	38	22	69	2.56	- 2.0	12	13,114	sw.	57	nw.	20	14	7	10	6.2
Providence.....	160 57	67	29.88	30.06	+	.08	38.2	+ 2.5	74	29 47	15	7	30	31	32	26	67	1.78	- 1.2	12	5,697	nw.	37	w.	20	13	9	9	5.0
Hartford.....	159 122	132	29.89	30.07	+	.03	38.2	+ 3.2	80	29 47	13	7	29	29	32	26	64	1.33	- 1.0	11	6,922	nw.	37	w.	20	13	6	12	5.6
New Haven.....	106 116	155	29.96	30.08	+	.09	38.2	+ 2.8	73	29 46	15	7	30	27	34	28	69	2.59	- 1.6	11	6,922	nw.	39	nw.	20	11	8	12	5.2
Mid. Atlantic States.																													
Albany.....	97 102	115	29.97	30.08	+	.07	36.9	+ 4.8	76	29 46	9	1	28	29	32	26	69	0.87	- 1.8	8	6,481	s.	37	nw.	20	6	13	12	6.1
Binghamton.....	875 79	90	29.11	30.06	+	.04	36.6	+ 4.6	80	29 47	- 6	7	26	37	36	30	68	1.23	- 1.8	11	5,264	w.	30	nw.	20	5	7	19	7.4
New York.....	314 108	350	29.73	30.07	+	.07	40.8	+ 3.3	75	29 48	16	7	34	25	36	30	68	3.80	- 0.2	15	8,813	nw.	58	nw.	20	10	10	11	5.3
Harrisburg.....	374 94	104	29.69	30.10	+	.07	42.6	+ 4.8	84	29 51	18	7	34	35	37	30	67	3.33	- 0.1	12	5,917	nw.	36	nw.	20	8	9	14	6.0
Philadelphia.....	117 116	184	29.96	30.09	+	.07	44.1	+ 4.1	86	29 52	18	7	36	32	39	34	71	2.81	- 0.4	15	8,317	nw.	40	n.	6	10	13	8	5.1
Scranton.....	805 111	119	29.19	30.07	+	.05	39.1	+ 4.2	82	29 48	5	7	30	33	34	27	65	2.09	- 0.4	16	5,788	sw.	32	nw.	20	5	10	16	6.6
Atlantic City.....	52 37	48	30.04	30.10	+	.08	41.8	+ 3.0	79	23 50	16	7	34	31	37	32	75	3.52	- 0.4	11	6,760	sw.	35	ne.	24	7	12	11	6.3
Cape May.....	17 48	52	30.09	30.11	+	.10	42.8	+ 2.0	76	23 51	18	7	35	30	37	32	75	2.74	- 1.6	13	7,186	s.	31	n.	6	7	18	6	5.4
Baltimore.....	123 69	117	29.95	30.09	+	.06	47.0	+ 5.1	86	22 56	21	7	38	43	40	32	63	2.94	- 1.2	12	5,692	nw.	36	nw.	2	10	8	13	5.7
Washington.....	112 39	76	29.97	30.10	+	.06	48.8	+ 6.6	93	23 60	22	7	38	50	42	37	71	2.79	- 1.4	13	3,167	nw.	19	nw.	6	11	10	10	5.5
Cape Henry.....	18 11	58	30.07	30.09	+	.06	50.0	+ 3.4	89	23 59	28	7	41	40	44	38	67	2.36	- 2.8	9	10,943	n.	56	nw.	6	12	12	7	5.0
Lynchburg.....	681 83	88	29.35	30.10	+	.05	52.6	+ 7.2	92	23 64	24	7	42	41	44	38	67	2.50	- 1.2	13	4,078	sw.	36	nw.	6	13	9	9	5.3
Mount Weather.....	1,725 10	37	28.22	30.08	+	.03	43.2	+ 6.4	85	23 52	16	7	34	41	39	35	77	3.07	- 1.2	10	7,803	n.	36	sw.	20	14	8	9	5.0
Norfolk.....	91 102	111	30.01	30.11	+	.08	52.4	+ 4.7	92	23 62	29	7	43	37	46	41	70	2.91	- 1.0	11	7,462	s.	45	sw.	13	13	8	9	4.7
Richmond.....	144 145	153	29.96	30.11	+	.07	52.1	+ 5.2	94	24 26	7	4	41	39	41	70	2.91	- 1.0	11	7,462	s.	45	sw.	3	14	7	10	4.8	
Wytheville.....	2,293 40	47	27.71	30.11	+	.06	61.1	+ 7.2	86	23 59	22	6	38	34	42	38	74	4.23	+ 0.4	16	5,308	w.	35	w.	3	14	7	10	4.8
S. Atlantic States.																													
Asheville.....	2,285 53	75	27.76	30.12	+	.06	54.2	+ 9.3	86	22 66	29	6	43	37	47	43	76	2.69	- 1.6	9	7,554	se.	33	nw.	14	10	16	5	4.6
Charlotte.....	773 68	76	29.28	30.12	+	.07	57.7	+ 6.9	91	23 68	32	7	48	31	49	42	65	2.09	- 2.6	9	6,441	sw.	35	sw.	19	12	11	8	4.8
Hatteras.....	11 12	47	30.09	30.10	+	.06	54.3	+ 2.9	82	23 62	33	7	47	26	50	48	85	1.81	- 4.3	6	12,628	ne.	54	ne.	25	16	10	5	4.1
Raleigh.....	376 71	79	29.71	30.12	+	.07	56.0	+ 5.6	94	23 67	28	7	45	37	48	41	65	3.38	- 0.7	8	5,705	sw.	25	sw.	19	13	12	6	4.6
Wilmington.....	78 81	91	30.04	30.12	+	.07	59.8	+ 6.1	94	23 70	32	7	49	32	51	46	71	4.40	- 2.6	8	7,254	sw.	34	ne.	25	12	14	5	4.3
Charleston.....	48 14	92	30.07	30.12	+	.06	65.0	+ 7.8	94	23 74	45	7	56	30	57	53	77	1.01	- 2.9	3	9,339	sw.	40	ne.	16	14	11	6	4.3
Columbia, S. C.....	351 41	57	29.73	30.12	+	.06	62.7	+ 8.7	93	23 74	37	7	51	35	53	46	64	0.88	- 3.6	9	6,062	sw.	33	sw.	14	7	19	5	5.1
Augusta.....	180 89	97	29.92	30.11	+	.05	64.4	+ 8.5	93	23 76	41	8	53	37	55	49	65	1.18	- 4.0	4	5,494	w.	38	nw.	14	13	14	4	4.0
Savannah.....	65 81	89	30.06	30.13	+	.07	67.1	+ 8.8	94	23 77	44	7	57	29	58	54	74	0.51	- 3.3	3	6,709	w.	28	n.	31	16	10	5	4.0
Jacksonville.....	43 101	129	30.08	30.13	+	.07	69.8	+ 7.9	91	24 79	53	4	60	31	62	60	81	0.76	- 2.7	4	7,263	sw.	28	ne.	31	20	8	3	3.5
Florida Peninsula.																													
Jupiter.....	28 10	48	30.10	30.13	+	.08	72.5	+ 3.1	86	21 80	59	28	64	24	67	65	83	0.19	- 2.8	7	7,382	se.	33	ne.	25	20	11	0	3.8
Key West.....	22 10	53	30.09	30.11	+	.06	75.0	+ 2.2	83	24 80	64	7	70	14	68	65	76	0.00	- 1.2	0	5,788	e.	24	e.	26	28	2	1	1.9
Sand Key.....	25 41	71	30.08	30.11	+	.06	75.4	+ 2.2	84	15 78	68	7	73	11	68	65	76	0.00	- 1.2	0	5,788	e.	24	e.	26	28	2	1	1.9
Tampa.....	35 79	96	30.10	30.14	+	.07	72.2	+ 6.3	92	25 83	53	4	62	30	64	61	80	2.80	- 2.8	0	5,695	w.	26	ne.	25	26	5	0	1.5
East Gulf States.																													
Atlanta.....	1,174 190	216	28.89	30.14	+	.08	61.5	+ 9.1	87	22 72	40	6	51	28	52	45	63	2.04	- 3.4	6	7,938	nw.	36	w.	2	20	6	5	3.6
Macon.....	370 55	66	29.73	30.13	+	.07	65.3	+ 10.5	91	22 77	41	3	53	33	53	59	56	1.22	- 4.0	4	4,055	w.	22	ne.	31	1	7	6	3.2
Thomasville.....	273 8	57	29.84	30.13	+	.07	68.8	+ 8.6	92	21 82	44	3	56	35	59	56	75	1.28	- 3.4	3	4,479	sw.	21	e.	25	16	12	3	3.4
Pennsacola.....	56 79	96	30.07	30.13	+	.07																							

TABLE I.—Climatological data for U. S. Weather Bureau stations, March, 1907—Continued.

Stations.	Elevation of instruments.			Pressure, in inches.		Temperature of the air, in degrees Fahrenheit.										Precipitation, in inches.			Wind.					Clear days.	Partly cloudy days.	Cloudy days.	Average cloudiness during daylight, tenths.	Total snowfall.		
	Barometer above sea level, feet.	Thermometers above ground.	Anemometer above ground.	Actual, reduced to mean of 24 hours.	Sea level, reduced to mean of 24 hrs.	Departure from normal.	Mean max. + mean min. + 2.	Departure from normal.	Maximum.	P.m.	Mean maximum.	Minimum.	Date.	Mean minimum.	Greatest daily range.	Mean wet thermometer.	Mean temperature of the dew-point.	Mean relative humidity, per cent.	Total.	Departure from normal.	Days with .01, or more.	Total movement, miles.	Prevailing direction.						Miles per hour.	Direction.
Up. Lake Reg.—Cont.																														
Grand Rapids.....	707 121	162	29.26	30.05	+.02	38.5	+ 5.5	74	25	47	13	6	30	33	34	31	78	2.74	+ 0.4	15	8,991	nw.	50	sw.	29	3	10	18	7.4	5.1
Houghton.....	668 66	74	29.26	30.01	-.03	25.4	+ 1.6	51	25	34	-10	6	17	39	34	31	78	3.29	.....	10	6,423	nw.	35	sw.	19	8	14	9	5.6	13.5
Marquette.....	734 77	116	29.21	30.04	-.00	28.4	+ 4.7	59	22	36	3	6	21	28	25	20	75	1.34	- 0.5	12	8,410	nw.	36	nw.	19	4	14	13	6.5	7.7
Port Huron.....	638 70	120	29.33	30.04	+.01	36.0	+ 6.7	71	22	44	10	4	28	31	32	28	79	2.38	- 0.2	15	9,696	w.	45	nw.	5	6	9	16	6.9	8.0
Sault Ste. Marie.....	614 40	61	29.33	30.05	+.02	25.0	+ 8.2	53	22	34	-10	6	16	38	23	20	82	1.85	+ 0.6	14	8,038	nw.	61	nw.	19	4	7	20	7.6	8.0
Chicago.....	823 140	310	29.14	30.04	-.01	42.6	+ 8.2	80	23	51	23	3	31	28	33	29	78	2.94	+ 0.5	12	12,233	ne.	48	w.	29	3	15	13	6.5	2.1
Milwaukee.....	681 122	142	29.30	30.05	-.01	38.6	+ 7.7	69	22	46	16	3	31	29	33	29	77	2.92	+ 0.4	10	8,512	w.	38	sw.	29	8	11	12	6.1	3.3
Green Bay.....	617 49	86	29.34	30.02	-.02	34.0	+ 7.2	62	27	41	10	3	26	28	30	25	73	2.04	- 0.1	9	8,335	w.	48	sw.	19	4	11	16	7.0	2.1
Duluth.....	1,133 11	47	28.76	30.02	-.04	24.6	+ 0.5	50	22	33	2	31	17	26	22	18	82	1.56	- 0.1	11	10,453	ne.	56	nw.	19	10	7	14	5.4	9.8
North Dakota.																														
Moorhead.....	940 8	57	29.00	30.06	-.02	22.5	+ 1.6	62	24	34	- 8	3	15	34	22	21	91	0.87	+ 0.1	6	7,771	nw.	36	sw.	21	4	16	11	5.4	5.4
Bismarck.....	1,674 8	57	28.19	30.04	-.02	26.9	+ 4.8	78	21	38	- 9	1	15	44	22	17	72	1.09	0.0	4	8,639	nw.	70	w.	21	12	12	7	4.3	5.4
Devils Lake.....	1,482 11	44	28.38	30.02	-.03	17.8	- 0.7	50	24	29	-11	2	7	36	-16	12	78	0.64	.....	10	10,382	w.	49	w.	21	16	8	7	4.3	6.2
Williston.....	1,875 14	44	27.94	29.99	-.05	21.0	- 0.6	56	23	32	-16	1	10	39	18	16	83	0.66	+ 0.2	5	6,743	nw.	41	w.	21	6	15	10	6.2	6.6
Upper Miss. Valley.																														
Minneapolis.....	102 208		29.10	30.04	-.01	31.4	+ 7.9	64	25	40	5	3	23	28	22	22	74	2.23	0.0	6	9,519	nw.	42	nw.	19	14	9	8	4.6	5.8
St. Paul.....	837 171	179	29.10	30.04	-.01	31.2	+ 3.0	65	25	40	2	2	23	27	28	22	69	0.53	- 0.9	5	8,290	nw.	38	nw.	19	5	17	9	6.4	4.8
La Crosse.....	714 71	87	29.23	30.02	-.02	37.0	+ 6.1	73	26	45	11	2	29	32	25	29	77	1.69	+ 0.1	8	5,734	n.	28	w.	29	5	10	16	6.6	2.5
Madison.....	974 70	78	28.95	30.03	-.01	37.6	+ 7.5	76	26	46	15	7	14	29	39	32	80	1.80	- 0.4	11	8,343	nw.	40	sw.	29	8	6	17	6.2	3.4
Charles City.....	1,015 8	58	28.94	30.04	-.01	35.9	+ 7.5	84	26	46	7	14	26	39	32	29	82	2.17	+ 0.3	9	6,797	nw.	28	sw.	16	8	11	12	6.5	5.8
Davenport.....	606 71	79	29.36	30.05	-.00	43.7	+ 8.3	82	21	52	20	2	35	41	39	34	72	1.79	- 0.4	8	6,868	nw.	30	nw.	23	11	7	13	5.6	2.4
Des Moines.....	861 84	101	29.12	30.04	-.00	42.9	+ 7.2	88	25	52	14	14	33	47	37	32	70	1.18	- 0.3	7	7,319	sw.	40	sw.	26	5	16	10	6.1	3.6
Dubuque.....	698 100	117	29.29	30.06	+.02	40.9	+ 7.7	82	26	50	16	2	32	42	36	32	75	0.99	- 1.3	11	5,868	sw.	26	s.	26	11	8	12	5.4	1.9
Keokuk.....	614 64	77	29.37	30.06	+.03	47.6	+ 9.7	88	21	56	25	2	39	40	41	38	76	3.05	+ 2.9	9	6,817	sw.	36	w.	29	18	6	7	4.1	3.0
Calmar.....	336 87	93	29.69	30.08	+.04	57.4	+ 10.4	85	21	66	33	6	49	28	50	45	67	3.39	- 0.4	7	8,766	ne.	36	ne.	31	7	11	13	6.3	0.0
La Salle.....	536 56	64	29.48	30.06	+.03	43.7	+ 6.9	83	21	53	20	6	34	42	23	37	77	2.03	.....	11	7,523	sw.	40	sw.	29	10	7	14	5.8	2.4
Peoria.....	609 11	45	29.38	30.05	+.02	43.6	+ 8.6	87	21	55	23	6	36	40	40	37	77	2.34	.....	13	8,238	s.	40	w.	29	11	9	11	5.4	7.9
Springfield, Ill.....	644 10	92	29.36	30.05	+.02	49.1	+ 10.0	91	21	58	26	6	40	41	43	40	78	4.81	+ 2.1	13	8,087	s.	29	sw.	27	12	3	16	6.0	4.1
Hannibal.....	594 75	109	29.46	30.04	+.02	49.8	+ 8.2	91	21	59	26	2	41	41	43	40	78	2.67	0.0	9	8,863	sw.	38	w.	29	8	10	13	6.0	6.4
St. Louis.....	567 208	217	29.43	30.04	+.01	52.9	+ 9.4	90	21	62	30	6	44	37	46	41	70	2.39	- 1.1	11	9,759	sw.	31	nw.	7	10	10	11	5.5	T.
Missouri Valley.																														
Columbia, Mo.....	784 11	84	29.18	30.01	-.02	51.6	+ 10.2	92	21	62	27	2	42	35	45	40	70	2.90	0.0	10	8,098	s.	37	sw.	28	16	3	12	4.6	T.
Kansas City.....	968 78	95	29.00	30.05	+.03	52.1	+ 11.3	91	21	62	27	1	42	33	45	40	70	2.50	+ 0.3	9	6,580	s.	29	sw.	7	9	14	8	5.1	T.
Springfield, Mo.....	1,324 98	104	28.60	30.01	-.01	56.0	+ 12.5	92	20	67	26	8	46	37	47	41	64	1.48	- 2.2	9	9,696	s.	34	sw.	7	12	6	13	5.4	T.
Iola.....	984 40	47	28.95	30.00	-.01	53.0	+ 12.6	94	20	67	24	1	43	41	43	41	64	1.63	.....	6	8,155	sw.	30	sw.	26	5	12	14	6.6	T.
Topeka.....	85 89					51.7	+ 10.8	93	22	63	19	1	40	37	43	40	70	1.81	- 0.3	5	8,095	s.	35	s.	26	14	8	9	4.6	T.
Lincoln.....	1,189 11	84	28.71	30.00	-.02	44.5	+ 8.5	91	25	55	11	1	34	45	38	32	68	0.51	- 0.9	3	5,542	ne.	44	s.	26	12	8	11	5.9	3.8
Omaha.....	1,105 115	121	28.82	30.02	-.02	43.5	+ 7.5	91	25	52	13	1	35	41	37	31	66	0.29	- 1.2	4	7,204	n.	34	n.	26	7	5	19	6.5	2.7
Valentine.....	2,598 47	54	27.22	29.98	-.05	41.2	+ 9.3	81	21	54	- 4	1	28	46	34	25	65	0.70	- 0.8	5	8,227	sw.	41	w.	21	5	21	5	5.3	4.2
Sioux City.....	1,135 96	164	28.78	30.03	-.02	38.4	+ 5.8	81	21	48	- 5	0	2	28	40	36	25	0.26	- 1.0	5	9,633	nw.	40	s.	24	10	5	16	6.0	2.9
Pierre.....	1,572 70	75	28.30	30.00	-.05	39.6	+ 10.1	83	20	52	- 5	1	28	48	32	25	64	0.10	- 0.8	5	8,373	se.	62	sw.	21	9	11	11	5.8	0.2
Huron.....	1,306 56	67	28.60	30.03	-.03	35.2	+ 8.5	84	21	46	- 5	1	24	44	36	25	76	0.45	- 0.4	6	9,107	se.	38	s.	20	12	11	8	5.1	1.9
Yankton.....	1,																													

TABLE I.—Climatological data for U. S. Weather Bureau stations, March, 1907—Continued.

Stations.	Elevation of instruments.			Pressure, in inches.			Temperature of the air, in degrees Fahrenheit.										Precipitation, in inches.			Wind.					Partly cloudy days.	Cloudy days.	Average cloudiness during daylight, tenths.	Total snowfall.				
	Barometer above sea level, feet.	Thermometers above ground.	Anemometer above ground.	Actual, reduced to mean of 24 hours.	Sea level, reduced to mean of 24 hrs.	Departure from normal.	Mean max. + mean min. + 2.	Departure from normal.	Maximum.	Date.	Mean maximum.	Minimum.	Date.	Mean minimum.	Greatest daily range.	Mean wet thermometer.	Mean temperature of the dew-point.	Mean relative humidity, per cent.	Total.	Departure from normal.	Days with .01, or more.	Total movement, miles.	Prevailing direction.	Maximum velocity.								
																								Miles per hour.					Direction.	Date.		
<i>Mid. Pac. Coast Reg.</i>																																
Eureka	62	62	80	29.92	29.99	-.07	49.6	-2.9	62	5	52	35	12	41	19	44	41	80	3.00	+4.0	20	5,195	se.	40	se.	22	4	16	11	6.8	4.5	
Mount Tamalpais	2,375	11	18	27.49	29.99	-.07	42.3	-1.2	60	31	47	31	25	38	16	40	38	87	9.06	+5.6	20	13,593	sw.	56	s.	17	6	4	21	7.5		
Point Reyes Light	490	7	18	29.42	29.94	-.08	49.2	-.1	61	30	53	38	25	45	12	45	40	76	6.43	+2.0	20	17,580	nw.	84	s.	23	5	11	15	6.8		
Red Bluff	332	50	56	29.60	29.96	-.08	48.3	-5.5	72	31	55	34	14	42	27	45	40	76	5.92	+2.6	21	5,592	se.	32	se.	22	7	6	18	7.0		
Sacramento	69	106	117	29.93	30.00	-.03	50.9	-3.3	72	31	57	37	12	45	23	47	42	75	7.28	+4.3	19	7,326	se.	44	se.	23	11	2	18	6.8		
San Francisco	155	200	204	29.83	30.00	-.06	51.0	-1.7	69	30	56	38	25	46	22	47	44	79	8.42	+5.3	20	6,275	s.	42	sw.	23	6	7	18	6.8		
San Jose	141	78	88	29.86	30.01	-.01	50.8	-2.9	73	30	59	32	13	43	32	43	42	75	7.75	.....	18	.....	nw.	.....	.....	6	6	19	7.2			
Southeast Farallon	30	9	17	29.95	29.98	.....	50.8	.....	59	7	54	40	26	47	11	.....	.....	.....	6.14	.....	21	14,324	nw.	64	se.	5	6	14	11	6.3		
<i>S. Pac. Coast Reg.</i>																																
Fresno	330	67	70	29.67	30.04	+.03	54.4	-0.3	77	31	62	32	13	44	30	48	43	73	3.57	+1.4	13	4,162	nw.	26	sw.	20	7	3	21	7.4		
Los Angeles	338	116	123	29.68	30.05	+.03	55.5	-0.1	84	17	65	39	27	46	34	49	43	69	4.12	+1.1	11	4,056	w.	32	se.	4	6	10	15	6.3		
San Diego	87	94	102	29.95	30.05	+.03	56.6	+0.4	82	18	65	40	13	48	28	51	46	73	1.62	+0.1	9	4,655	nw.	30	n.	4	21	5	5	3.1		
San Luis Obispo	201	47	54	29.84	30.06	+.00	52.6	-1.2	80	30	61	34	12	44	29	48	46	80	6.79	+3.8	17	4,060	se.	25	s.	20	4	10	17	6.6		
<i>West Indies.</i>																																
Grand Turk	11	6	20	30.08	30.09	+.07	74.9	.....	84	18	82	61	25	68	.....	.....	.....	.....	0.43	.....	7	.....	e.	.....	.....	.....	.....	.....	.....	.....	.....	
San Juan	82	48	90	29.95	30.04	+.02	74.0	.....	80	9	79	64	31	69	16	68	65	73	1.80	-0.5	19	8,434	ne.	32	e.	17	17	13	1	3.2		
<i>Panama.</i>																																
Ancon	74	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	
Naos	40	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	

TABLE II.—Climatological record of cooperative observers, March, 1907.

Temperature. (Fahrenheit.)						Precipitation.		Temperature. (Fahrenheit.)						Precipitation.		Temperature. (Fahrenheit.)						Precipitation.					
Stations.						Rain and melted snow.	Total depth of snow.	Stations.						Rain and melted snow.	Total depth of snow.	Stations.						Rain and melted snow.	Total depth of snow.				
Maximum.	Minimum.	Mean.	Ins.	Ins.	Maximum.			Minimum.	Mean.	Rain and melted snow.	Total depth of snow.	Maximum.	Minimum.			Mean.	Rain and melted snow.	Total depth of snow.	Maximum.	Minimum.	Mean.			Rain and melted snow.	Total depth of snow.		
Alabama.								Alaska—Cont'd.								Arizona—Cont'd.											
Alaga	90	33	62.2	0.56				Copper Center	36	—40	16.2	0.30	3.0	San Simon	92	21	52.9	0.40									
Ashville	90	33	62.2	2.51				Juneau	49	6	31.0	2.74		Seligman	78	17	44.5	1.14									
Auburn	86	43	65.1	2.33				Killisnoo	50	8	29.6	1.70		Sentinel	96	35	62.0	0.45									
Benton	90	39	66.6	3.79				Loring	43	0	29.4	4.98	24.2	Silverbell	93	37	61.8	0.53									
Bermuda	90	39	66.6	2.24				Orea	50	5	25.7	2.15	23.0	Tempe	94	29	58.8	1.00									
Boligee	92	40	67.0	2.24				Sitka	49	9	32.3	1.75	10.5	Thatcher	93	20	55.0	0.13									
Bridgeport				4.21				Skagway	42	2	24.5	0.47	T.	Tombstone	87	32	56.8	0.21									
Campbell	914	39	63.6	0.86				Teikhill	42	—28	7.8	0.56	9.0	Tucson	95	24	58.4	0.56									
Cedar Bluff				3.48				Wood Island	42	—28	7.8	0.56	9.0	Upper San Pedro	93	22	54.7	0.26									
Citronelle	90	45	68.8	4.32				Arizona.								Vall	98	48	70.8	0.02							
Clanton	93	37	65.0	3.76				Allaire Ranch				0.14		Walnut Grove				2.40									
Cordova	92	33	64.0	2.07				Astec	103	35	67.8	0.80		Willcox	92	24	57.4	0.00									
Dadeville				1.32				Benson	94	26	57.4	0.13		Yarnell				2.82									
Daphne	84	51	68.4	2.60				Bisbee	86	28	54.2	0.48		Young	85	20	48.0	2.05									
Decatur	93	30	62.4	3.75				Bonita				0.27		Arkansas.													
Demopolis				4.88				Bowie	95	21	57.4	0.23		Alicia	88	29	62.6	1.50									
Eufaula	87	40	64.4	1.90				Buckeye	93	29	59.0	0.98		Amity	88	30	63.0	3.47									
Flomaton	92	45	70.4	1.87				Casagrande				0.50		Arkadelphia	87	30	63.5	4.03									
Florence	90	31	61.4	3.40				Charlons Mill	51	21	33.6	1.87	1.0	Arkansas City				7.41									
Fort Deposit	89	42	66.4	2.29				Clifton				0.09		Batesville	90	30	61.4	2.30									
Gadsden	93	35	64.4	4.16				Cline	86	27	56.0	2.49		Beebranch	90	31	61.8	1.38									
Goodwater	93	39	65.2	2.54				Cochise	72	30	56.0	0.00		Benton				3.65									
Greensboro	88	42	66.7	2.92				Columbia	86	32	53.6	2.25		Black Rock				2.42									
Guntersville				3.04				Congress	86	35	56.0	2.16		Brinkley	92	31	62.8	6.04									
Hamilton	89	33	62.4	4.63				Douglas	94	23	56.8	0.37		Calico Rock				1.20									
Highland Home	92	44	67.9	3.72				Dudleyville	95	29	58.0	0.92		Camden	87	35	65.4	5.41									
Hohokum				3.30				Duncan	94	19	55.5	0.06		Center Point	94	30	64.6	3.98									
Letohatchie				1.54				Fort Apache	84	20	49.4	0.61	T.	Clarendon				3.71									
Livingston	86	34	64.2	2.94				Fort Huachuca	86	30	55.0	0.10	T.	Conway	91	31	62.2	2.50									
Lock No. 4	90	34	63.2	2.42				Fort Mohave	93	38	62.0	1.85		Corning	88	29	61.6	3.15									
Lucy	92	38	68.0	1.35				Fredonia	81	10	44.3	0.50		Dardanelle				1.74									
Madison Station	90			3.17				Gilaband	97	37	61.1	0.50		Des Arc	93	32	62.2	4.27									
Maple Grove	91	33	60.6	3.94				Globe	89	28	54.8	1.26		Dodd City	92	27	59.7	1.10									
Milstead				2.24				Grand Canyon	74	14	42.6	2.37	10.5	Dutton	87	28	58.1	3.71									
Newbern	86	39	65.7	2.91				Greenville	89	25	53.0	0.11		Eldorado	89	34	65.0	5.16									
Oneonta	90	31	63.3	2.93				Greer				1.90	4.0	England	894	324	62.34	2.37									
Opelika	90	41	65.7	2.40				Holbrook	89	18	48.8	0.71	0.5	Eureka Springs	93	28	59.6	3.01									
Prattville	92	35	65.2	2.70				Huachuca Reservoir				0.80		Fayetteville	96	30	60.8	2.63									
Pushmataha	93	36	66.0	4.00				Jerome	82	29	51.2	2.70	T.	Forrest City	87	31	60.2	3.19									
Riverton	89	29	58.1	4.35				Keams Canyon	77	15	43.6	1.17	1.0	Fulton				3.26									
Scottaboro	89	32	61.8	3.63				Kingman	85	24	51.6	1.21	T.	Hardy	91	25	56.8	1.70									
Selma	92	39	66.1	3.58				Maricopa	98	29	60.0	0.86		Harrison	92	28	62.2	0.90									
Spring Hill	86	45	68.7	2.90				Mesa	94	32	59.6	1.18		Heber	88	37	63.8	7.85									
Talladega				3.19				Mohawk Summit	95	40	69.0	0.83		Helena	88	33	65.6	3.87									
Tallassee				1.72				Natural Bridge				3.17	T.	Hope	88	35	65.6	3.87									
Thomasville	90	40	65.2	5.18				Nutrisco	84			0.88	0.5	Hot Springs	87	29	62.2	2.92									
Tuscaloosa	92	36	63.8	3.29				Oracle	84	32	54.2	2.57	1.0	Jonesboro	90	27	60.8	3.81									
Tuscumbia	87	35	62.3	2.52				Paradise	88	22	54.2	0.21	T.	Junction	88	32	65.8	5.36									
Tuskegee	92	43	66.8	2.33				Parker	100	25	57.5	0.00		La Crosse	91	32	60.2	3.07									
Union Springs	90	44	66.0	4.70				Phoenix (Ex. Farm)	91	30	58.9	1.00		Lewisville	904	324	67.24	2.43									
Uniontown	91	41	66.8	2.19				Picacho	94	40	66.2	0.50		Lutherville	91	27	60.2	1.95									
Valleyhead	90	30	59.2	2.78				Pinal Ranch				2.60	0.5	Luxora				1.20									
Vienna				2.90				Pinto				0.42	2.0	Malvern	88	30	59.4	5.50									
Wetumpka	91	38	66.6	3.62				Roosevelt	82	31	52.3	1.66		Mammoth Springs	93	26	57.8	1.08									
Alaska.								St. Michaels	75	10	41.4	1.13		Marked Tree				2.00									
Chestochena	36	—39	4.3	0.80	8.0			San Carlos	95	24	56.8	1.07		Marvell	88	33	63.6	5.87									

TABLE II.—Climatological record of cooperative observers—Continued.

Temperature. (Fahrenheit.)						Precipitation.		Temperature. (Fahrenheit.)						Precipitation.		Temperature. (Fahrenheit.)						Precipitation.		
Stations.						Rain and melted snow.	Total depth of snow.	Stations.						Rain and melted snow.	Total depth of snow.	Stations.						Rain and melted snow.	Total depth of snow.	
Maximum.	Minimum.	Mean.			Maximum.			Minimum.	Mean.			Maximum.	Minimum.			Mean.			Maximum.	Minimum.	Mean.			
Arkansas—Cont'd.								California—Cont'd.								Colorado—Cont'd.								
Mena.....	87	31	62.6		2.35			Mercury.....						22.10				Breckenridge.....	58	-3	28.7		0.35	5.5
Montrose.....	89	38	65.8		7.21			Mills College.....						10.28				Buena Vista.....	68	11	39.4		0.21	2.0
Mossville.....	85	29	57.2		3.26			Milo.....						5.41				Burlington.....	89	7	46.6		1.08	
Mount Nebo.....	87	33	59.6		1.43			Milton (near).....	71	34	51.2			9.27				Canyon.....	83	22	51.7		0.09	0.4
Newport.....	89	32	61.6		1.26			Mohave.....	77	30	51.3			2.62				Castlerock.....	72	6	41.4		0.82	9.0
Ozark.....	90	31	62.2		2.59			Mokelumne Hill.....	72	30	48.0			15.66				Cheesman.....	73	10	44.2		0.30	3.5
Pinebluff.....	93	28	60.2		4.51			Mono Ranch.....	71	24	43.0			17.93				Cheyenne Wells.....	91	10	46.9		0.13	T.
Pocahontas.....	93	28	60.2		3.28			Montague.....	65	20	40.4			4.25				Chromo.....	76	-2	37.0		2.02	16.5
Pond.....	92	25	59.1		2.08			Monterey.....	70	30	48.4			4.53				Clearview.....	66	2	35.8		0.20	2.5
Prescott.....	88	33	62.3		4.32			Monumental.....	57	17	38.0			17.70				Collbran.....	77	6	41.6		2.58	26.5
Princeton.....	89	29	65.1		2.57			Mount St. Helena.....						24.20				Colorado Springs.....	78	13	45.3		0.16	1.6
Rogers.....	91	28	59.8		2.42			Napa.....	71	34	50.6			8.37				Cope.....	86	9	46.1		0.85	5.0
Russellville.....	90	30	60.0		1.78			Needles.....	85	28	57.3							Corona.....	51	-10	21.0		4.22	40.5
Spiegelville.....	94	32	65.0		1.89			Nevada City.....	72	21	41.6			24.62				Cripple Creek.....					0.39	7.5
Stuttgart.....	87	32	62.4		3.76			New Castle.....	75	34	50.0			14.10				Delta.....	81	13	45.9		0.13	0.5
Texarkana.....	90	36	68.6		2.30			Newman.....	73	34	51.8			3.82				Dunkley.....	60	0	34.1		1.63	21.9
Warren.....	95	31	64.2		0.53			Niles.....	68	36	51.4			10.09				Eagle.....	68	4	37.0		1.17	12.8
White Cliffs.....					4.10			Nimshew.....	68	20	42.4			27.69				Eureka.....					2.37	24.0
Wiggins.....	87	27	61.3		3.63			North Bloomfield.....	70	17	39.8			28.64				Fort Collins.....	80	3	43.3		0.69	5.7
Witt Springs.....	84	30	57.2		1.33			Oakland.....	70	37	51.6			9.08				Fort Morgan.....	85	11	47.1		0.12	0.5
California.								Ojai Valley.....	84	30	52.7			8.73				Fowler.....					0.05	0.8
Alturas.....	62	4	35.6		4.13	T.		Orland.....	77	31	48.8			3.97				Frances.....	58	10	34.6		1.35	26.5
Angola.....	80	23	49.6		0.85			Orleans.....	82	32	51.7			12.01				Garnett.....	72	1	35.1		0.00	
Auburn.....	66	34	47.6		16.66			Oroville (near).....	77	34	51.0			10.90				Gladstone.....					3.94	53.4
Asusa.....	85	32	52.8		5.39			Ozona.....						6.46				Glenwood.....	74	11	40.7		1.06	8.0
Bagdad.....	90	41	60.4		0.70			Palermo.....	78	30	50.8			8.80				Gothie.....	54	-6	27.8		3.27	45.8
Bakersfield.....	83	21	52.5		0.61			Pilot Creek.....						32.88				Grand Valley.....	79	19	44.8		2.41	6.0
Bear Valley.....					35.50	172.0		Placer.....	77	39	53.5			8.16				Greeley.....	83	6	45.7		0.42	2.0
Berkeley.....	68	38	50.4		10.76			Placerville.....	69	26	47.0			20.54				Grover.....					0.20	2.5
Bishop.....	79	20	46.6		1.41	1.5		Point Lobos.....	65	46	55.6			7.64				Gunnison.....	69	6	36.8		0.43	4.6
Blackburg.....	67	25	42.4		21.83	14.0		Porterville.....	80	31	54.8			2.66				Hahns Peak.....	58	-4	27.7		2.38	31.5
Blue Canyon.....	63	18	36.6		35.11	157.0		Poway.....	86	30	54.0			2.45				Hampden.....	82	9	42.6		0.27	3.2
Bowman.....					31.46	210.5		Priest Valley.....						10.00				Hoehne.....	87	4	46.7		T.	
Branscomb.....	65	25	41.3		26.69	15.5		Quincy.....	53	18	35.8			30.15				Holly.....	96	10	52.7		T.	T.
Brush Creek.....	72	26	42.8		33.02	13.5		Redding.....	70	32	49.0			7.28				Holyoke (near).....	86	1	48.4			
Butte Valley.....					26.76	112.0		Redley.....	78	30	53.3			3.89				Idaho Springs.....	68	9	40.4		0.35	3.5
Calico.....	92	42	62.0		0.42			Redlands.....	85	33	52.7			4.30				Lake City.....	67	-3	35.9		0.45	3.0
Campbell.....	70	31	50.8		8.87			Represa.....						12.39				Lake Moraine.....	61	-2	32.2		0.56	11.0
Campo.....					3.91	T.		Rialto.....	87	34	53.6			10.70				Lamar.....	94	14	52.2		0.03	T.
Cedarville.....	64	14	34.4		3.31	23.0		Riverside.....	86	31	53.6			3.49				Laport.....					0.35	5.0
Chico.....	76	28	49.2		8.03			Rocklin.....	74	31	51.2			12.46				Las Animas.....	94	11	51.0		0.00	
Claremont.....	85	33	53.6		5.37			Rohnerville.....	68	31	47.1			11.40				Lay.....	73	13	38.9		0.51	5.5
Cloverdale.....	76	31	49.6		19.08	0.2		Sacramento.....	72	34	51.6			9.54				Leroy.....	84	14	44.6		0.25	2.6
Cofax.....	70	25	48.2		19.46	20.0		Salinas.....	71	30	53.4			6.87				Longs Peak.....	59	-1	32.7		2.29	34.0
Colusa.....	70	32	49.9		3.80			Salton.....	95	54	64.9							Lujane.....	75	15	42.4		0.76	7.0
Craftonville.....					6.67	0.2		San Bernardino.....	88	28	53.8			4.58				Mancos.....	74	6	40.2		1.76	6.3
Crescent City.....					14.10			San Jacinto.....	90	29	54.8			2.98				Meeker.....	72	4	40.4		0.98	8.0
Crocker.....					27.41	70.0		Santa Barbara.....	70	36	54.0			5.64				Montrose.....	70	15	43.8			
Cuyamaca.....	64	21	37.9		11.38	2.0		Santa Clara College.....	74	31	50.7			9.22				Moraine.....	62	-9	34.2		1.35	17.5
Delta.....	77	28	47.3		24.45	0.5		Santa Cruz.....	76	32	52.2			10.85				Pagoda.....	70	3	37.8		1.33	
Dimond.....	74	35			10.81			Santa Maria.....	78	36	55.2			3.95				Pagosa Springs.....	73	4	38.0		2.27	1.5
Dobbins.....					19.43			Santa Monica.....	77	38	53.2			5.37				Paonia.....	78	18	44.8		1.42	3.5
Durham.....	78	29	50.4		8.39			Santa Rosa.....	72	29	49.0			11.21				Platte Canyon.....					0.43	4.5
El Cajon.....	90	30	56.6		3.06			Sausalito.....						9.70				Power House.....	74	12	40.0		1.76	4.2
Electra.....	76	35	53.2		18.01			Shasta.....	77	29	48.6			14.47				Rangely.....	77	9	42.0		0.57	5.0
Elmwood.....	68	30	52.6		3.26			Sierra Madre.....	79	37	52.4			6.33				River Portal.....	72	16	40.6		0.65	0.7
Elsinore.....	89	26	53.2		3.68			Sisson.....	67	16	37.6			13.16				Rockyford.....	92	10	48.8		0.00	
Emigrant Gap.....	51	13	30.0		30.20	160.0		Snedden.....						8.60				Saguache.....	75	9	38.0			

TABLE II.—Climatological record of cooperative observers—Continued.

Stations.	Temperature. (Fahrenheit.)			Precipitation.	
	Maximum.	Minimum.	Mean.	Rain and melted snow.	Total depth of snow.
<i>Delaware—Cont'd.</i>	°	°	°	Ins.	Ins.
Newark	83	16	43.6	2.62	10.0
Seaford	88	19	46.6	2.72	3.5
<i>District of Columbia.</i>					
West Washington	93	20	47.6	3.10	6.4
<i>Florida.</i>					
Apalachicola	88	52	70.2	0.55	
Archer	97	47	72.1	0.57	
Avon Park	96	50	73.6	0.24	
Bartow	97	46	72.3	0.81	
Bonifay	91	42	69.3	0.92	
Brooksville	92 <sup>h</sup>	50 <sup>h</sup>	71.5 <sup>h</sup>		
Carrabelle	90	45	68.0	0.75	
Clermont	98	50	74.5	T.	
De Funiak	91	45	69.0	2.92	
Deland	95	47	73.4		
Eustis	96	47	73.0	0.09	
Federal Point	99	49	71.4	1.06	
Fenholloway	95	43	69.8	1.05	
Fernandina	95	49	70.6	0.62	
Flamingo	98	54	75.6	0.00	
Fort Meade	97	44	72.0	T.	
Fort Myers	92	53	71.8	0.08	
Fort Pierce	86	48	69.4	0.68	
Gainesville	96	49	72.4	0.32	
Gramercy	92	50	72.2		
Huntington	95	50	71.6	1.44	
Hypoluxo	90	54	72.1	0.00	
Inverness	94	46	70.6	0.03	
Jasper	93	43	69.8	0.56	
Kissimmee	93	44	71.5	T.	
Lake City	94	47	72.6	1.00	
Maccleenny	94	43	68.8	0.73	
Madison				0.07	
Malabar	91	51	71.4	0.32	
Manatee	88	48	69.8	0.00	
Marianna	94	40	68.9	1.90	
Merritts Island	88	58	72.6	0.00	
Miami	92 <sup>h</sup>	56 <sup>h</sup>	72.5 <sup>h</sup>	0.72	
Middleburg	96	42	69.8	0.90	
Molokai	92	37	65.8	2.73	
Monticello	91	46	69.4	0.53	
Mount Pleasant	94	41	70.4	1.60	
New Smyrna	90	47	70.6	0.00	
Ocala	97	49	73.2	0.77	
Orange City	98	47	72.9	0.40	
Orlando	97	49	73.7	0.15	
Plant City	99	43	73.2	0.00	
Rockwell	95 <sup>h</sup>	46 <sup>h</sup>	70.2 <sup>h</sup>	0.10	
St. Andrew	88	44	68.2	1.25	
St. Augustine	94	47	70.2	0.96	
St. Leo	95	46	72.9	T.	
Switzerland	93 <sup>h</sup>	45 <sup>h</sup>	70.6 <sup>h</sup>	0.75	
Tallahassee	90	48	69.6	0.27	
Tarpon Springs	88	44	69.5	0.00	
Wausau	94	38	69.6	1.85	
<i>Georgia.</i>					
Abbeville				0.38	
Adairsville	86	36	60.2	3.52	
Albany	93	41	68.4	2.19	
Americus	89	43	65.1	1.31	
Athens	86	38	60.0	2.03	
Bainbridge	93	39	69.4	0.93	
Blakely	96	41	69.0	2.12	
Brunswick	99	42	69.5	2.64	
Butler				1.81	
Camak	91	37	61.8	1.45	
Canton				2.50	
Carleton				2.02	
Carrollton	90	35	60.8	0.60	
Clayton	89	32	56.8	3.44	
Columbus	92 <sup>h</sup>	41 <sup>h</sup>	68.1 <sup>h</sup>	0.92	
Cordele	87	43	66.6	0.91	
Cuthbert	93 <sup>h</sup>	44 <sup>h</sup>	67.6 <sup>h</sup>	1.82	
Dahlonega	88	35	59.4	3.29	
Dawson	96	44	70.8	1.34	
Diamond	85	33	57.8	4.10	
Dublin				0.60	
Dudley	93	43	67.4	0.96	
Eastman	89	44	66.8	0.40	
Eatonville	91	36	63.1	2.28	
Elberton	91	37	62.2	1.84	
Experiment	88	39	63.2	1.36	
Fitzgerald	95	40	68.4	1.13	
Fleming	96	36	66.8	0.96	
Fort Gaines	92	41	67.1	1.58	
Gainesville	86	36	58.5	2.42	
Gillsville	91	36	60.7	2.33	
Greenville	92	41	66.8	1.65	
Greenbush	85	32	59.7	4.12	
Greensboro	91	36	61.6	2.29	
Griffin	91	39	64.2	1.57	
Harrison	93	42	64.6	1.71	
Hawkinsville	96	35	66.2	1.31	
Helena	92	38	68.4	1.20	
Lisbon	93	34	62.4	1.18	
Lost Mountain	89	35	62.4	2.28	
Louisville	92	41	65.6	1.65	
Lumpkin	91	40	65.8	1.61	
<i>Georgia—Cont'd.</i>	°	°	°	Ins.	Ins.
Marshallville	92	40	66.4	1.46	
Mauzy	96	42	70.0	0.48	
Milledgeville	90	37	62.9	1.18	
Millen	97	39	65.3	0.81	
Montezuma				0.74	
Monticello	91	40	63.9	2.50	
Morgan	91	43	68.5	2.62	
Newnan	90	39	63.0	3.57	
Oakdale				2.20	
Point Peter	92	35	61.7	2.04	
Putnam	93	39	67.0	1.64	
Quitman	92	44	69.0	1.20	
Ramsey	88	35	62.1	3.40	
Rosaca				3.37	
Rome	92	34	61.8	2.86	
St. George	95	45	70.0	0.23	
St. Marys	96	43	69.4	0.58	
Screen	95	41	69.2	1.06	
Statesboro	97	42	66.6	1.42	
Talbotton	91	40	65.1	2.57	
Tallapoosa	90	37	64.0		
Toccoa	90	34	59.0	3.22	
Valdosta	94	45	70.1	1.00	
Valona	95	38	66.6	1.87	
Washington	89	38	61.0	3.51	
Waycross	95	44	69.4	2.01	
Waynesboro	94	40	66.6	0.16	
Westpoint	95	35	64.4	2.27	
Woodbury	89	34	62.2	1.86	
<i>Idaho.</i>					
Albion	63	8	38.1		
American Falls	64	21	38.4	3.83	
Blackfoot	62	20	37.8	3.58	
Buhl	63	20	40.9	1.29	8.5
Burke	49	11	30.2	5.17	49.0
Caldwell	72	25	44.2	2.45	
Cambridge	66	29	42.9	3.46	T.
Chesterfield	59	10	34.0	3.06	29.0
Dent	68	22	40.1	3.59	3.7
Dewey	56 <sup>h</sup>	8 <sup>h</sup>	31.0 <sup>h</sup>	3.44	26.5
Driggs	57	8	29.4	4.74	32.9
Ellerslie	63	19	40.4	3.08	2.2
Emmett	71	24	43.9	3.11	
Forney	63	1	32.6	1.39	5.5
Garnet	75	26	47.2	2.41	
Grace	60	10	36.6	3.87	23.5
Hot Springs	75	26	44.6	2.16	
Idaho Falls	62	22	37.8	3.59	7.0
Kellogg	66	19	38.6	3.43	
Lake	46	2	27.8	4.85	36.0
Lakeview	55	21	37.0	2.65	12.0
Landore	83	9	30.0	7.66	38.8
Lardo	54	6	29.6	7.62	63.9
Lost River	52	1	30.5	1.69	5.5
Meadows	60	15	35.8	2.88	19.0
Milner	64	20	38.0	3.07	15.0
Moscow	60	25	38.0	2.79	7.7
Mountain Home	68	24	41.0	2.53	
Murray	64	10	35.5	4.23	20.0
Murtaugh	64	19	38.4	4.23	6.0
Nevens Ranch				5.85	
Oakley	70	14	39.8	2.62	17.0
Orofino	72	23	42.8	3.16	T.
Payette	70	23	44.1	1.37	T.
Pollock	65	26	44.4	2.47	
Poplars				2.73	
Porthill	53	17	36.6	1.96	11.0
Rupert	70	15	39.6	5.45	9.5
St. Maries	63	18	39.2	3.69	1.0
Salem				3.78	10.0
Salmon	66	21	38.2	0.92	4.3
Standrod				2.78	25.3
Twin Falls	65	19	41.7	4.80	
Vernon	61	16	34.2	3.11	
Weston	65	9	39.4	4.14	13.0
<i>Illinois.</i>					
Albion	84	26	52.8	4.74	
Aledo	85	19	44.9	2.87	3.5
Alexander	91	25	49.4	4.23	2.0
Antioch	81	18	42.9	1.65	2.0
Ashton	80	16	42.2	2.12	0.8
Astoria	89	21	46.6	2.59	8.0
Aurora	82	20	42.4	3.17	1.2
Beardstown				3.56	
Benton	88	28	56.0	2.26	
Bloomington	88	23	47.8	4.50	8.0
Bushnell	89	20	46.2	4.20	14.0
Cambridge	83	18	43.4	2.15	4.5
Carlinville	91	25	51.2	2.67	2.0
Carrollton	94	23	50.8	3.01	1.5
Charleston	86	24	49.8	4.42	5.0
Chester	90	31	56.1	2.63	
Ciana	89	27	54.6	3.34	T.
Coatsburg	88	20	47.3	3.63	6.0
Cobden	86	29	56.1	2.95	
Colchester	88	24	47.3	4.02	8.7
Decatur	88	24	47.2	4.75	9.0
Dixon	76	16	38.2	2.08	0.6
<i>Illinois—Cont'd.</i>	°	°	°	Ins.	Ins.
Dwight	84	21	45.0	2.22	4.5
Elgin	82	19	42.8	2.57	0.8
Equality	92	28	56.8	4.13	
Flora	86	27	52.4	3.09	T.
Friendgrove	80	27	52.5	5.01	
Galva	84	19	42.8	1.27	5.5
Grafton				2.38	
Greenville	88	27	50.6	2.65	
Griggsville	92	26	50.1	3.27	
Halfway	85	27	54.8	2.92	
Havana	91	25	50.1	2.64	6.0
Henry	85	21	46.0	3.20	5.0
Hillsboro	89	26	50.2	1.90	T.
Hoopeston	84	21	47.0	4.26	5.9
Joliet	84	23	43.7	3.00	2.0
Kishwaukee	81	16	42.2	2.15	1.0
Lagrange	83	21	41.7	2.71	2.0
Laharpe	87	22	46.4	6.40	8.0
Lanark	81	15	41.1	1.51	0.7
Laurel				4.23	T.
McLeansboro	85	29	54.4	2.97	
Martinsville	86	25	50.8	1.90	T.
Martinton	85	15	44.0	5.23	6.0
Minonk	85	20	45.5	1.72	5.0
Monmouth	88	21	45.4	2.02	6.0
Morrison	81	19	43.2	1.66	0.1
Morrisonville	87	26	49.6	2.03	1.0
Mount Carmel				4.50	
Mount Vernon	92	26	52.4	3.88	
New Burnside	85	28	55.4	3.77	
Olney	87	28	52.5	4.60	T.
Ottawa	83	20	45.8	2.55	4.0
Palestine	85	25	52.4	5.55	T.
Pana	83	26	49.4	2.91	T.
Paris	88	28	47.5	3.05	
Philo	86	21	47.2	4.22	6.5
Pontiac	84	22	46.4	2.74	6.0
Rantoul	87	19	47.4	3.54	5.4
Raum	86	29	55.3	4.04	
Riley	80	16	40.8	1.68	1.4
Robinson	85	25	52.0	5.47	0.2
Rushville	90	25	48.6	2.83	5.5
St. Charles	82	18	42.3	2.94</	

TABLE II.—Climatological record of cooperative observers—Continued.

Stations.	Temperature. (Fahrenheit.)			Precipitation.	
	Maximum.	Minimum.	Mean.	Rain and melted snow.	Total depth of snow.
Indiana—Cont'd.					
Princeton	85	27	54.3	3.84	
Rensselaer	86	12	45.7	6.37	7.0
Richmond	84	19	48.6	5.36	2.7
Rochester	75	20	44.6	5.81	5.2
Rockville	85	22	48.4	3.05	2.0
Rome	88	27	56.2	4.86	
Salamonia	82	14	46.6	3.82	4.0
Salem	86	24	52.2	5.71	2.5
Scottsburg	88	26	54.0	6.36	4.4
Seymour	87	23	51.4	2.02	
Shelbyville	85	21	49.7	4.49	2.5
South Bend	82	15	41.6	3.91	2.0
Syracuse	82	15	43.6	3.62	3.0
Terre Haute	83	26	51.7	4.10	3.0
Veedsburg	84	20	48.5	3.15	3.0
Vincennes	86	25	51.6	4.92	T.
Washington	84	25	50.4	4.61	
Worthington	84	24	52.0	5.92	3.0
Indian Territory					
Ada	93	32	63.4	3.70	
Calvin				4.08	
Chickasha	98	28	62.2	1.38	
Durant	99	32	62.1	3.47	
Fairland	94	31	60.2	3.10	
Fort Gibson				2.94	
Hartshorn	91	30	64.0	2.16	
Healdton	97	26	63.2	3.86	
Idabel	89	32	64.8	2.30	
Marlow	96	30	60.5	1.93	
Muskogee	92	32	60.0	2.66	
Okmulgee	98	28	61.4	1.52	
Paula Valley	97	27	62.6	2.25	
Ravia	98	29	64.6	2.62	
South McAlester	94	32	64.0	2.49	
Tulsa	99	31	60.1	2.31	
Unita	95	28	58.9	3.02	
Wagoner	93	32	60.4	1.94	
Webbers Falls	98	29	61.2	3.03	
Iowa.					
Afton	88	18	43.5	1.95	8.0
Albia	88	17	42.9	1.43	8.0
Algona	83	3	36.0	1.04	7.0
Allerton	87	18	43.3	1.90	5.9
Alta	85	7	37.4	0.54	2.1
Alton	79	3	37.2	1.24	6.5
Amama	84	17	42.4	1.05	3.1
Ames	88	3	40.7	0.27	2.2
Atlantic	91	3	42.4	0.77	4.0
Audubon	89	8	41.1	0.46	4.1
Baxter	87	6	41.4	2.65	3.5
Bedford	89	15	45.2	1.95	5.0
Belleplaine	85	13	41.2	0.82	1.5
Bloomfield	87	20	45.4	2.38	9.8
Bonaparte	88	21	45.2	2.00	2.3
Boone	88	9	39.4	0.87	2.0
Britt	82	5	36.0	1.65	3.9
Buckingham				1.44	1.1
Burlington	88	21	45.4	2.54	7.0
Carroll	87	9	39.0	0.50	3.9
Cedar Rapids	85	14	40.4	0.76	1.8
Chariton	88	15	43.4	1.90	8.0
Clarinda	92	17	44.3	1.22	7.0
Clearlake	81	6	36.2	0.80	3.0
Clinton	83	19	43.2	2.10	1.5
Columbus Junction	84	19	41.2	2.65	5.0
Corning	87	15	43.4	0.79	4.8
Corydon	87	17	45.2	1.56	7.4
Creston	87	19	42.3	2.22	7.0
Cumberland				0.38	3.0
Decorah	83	10	37.0	1.96	5.5
Delaware	80	11	38.9	0.73	2.2
Denison	87	10	41.0	0.88	4.6
Desoto	88	8	42.6	0.67	4.0
Dows	83	5	37.2	1.61	2.2
Earlham	87	15	41.1	0.83	4.0
Elkader	85	8	39.2	1.56	4.5
Elliott	87	11	43.0	0.30	3.0
Estherville	83	6	34.0	0.60	4.0
Fayette	83	5	37.4	1.33	5.4
Forest City	84	8	34.8	1.39	2.8
Fort Dodge	86	11	38.4	1.16	1.5
Fort Madison				2.34	7.0
Galva	94	10	38.9	0.30	0.5
Gilman				1.38	3.0
Grand Meadow	81	10	37.0	1.63	4.8
Grinnell	87	10	43.0	1.30	5.5
Grundy Center	85	9	40.2	1.30	2.0
Guthrie Center	87	10	41.2	0.93	3.0
Hampton	85	9	37.8	2.75	3.6
Hancock	88	10	42.8	0.28	2.5
Harlan	90	70	41.8	0.40	3.5
Hopeville	89	18	43.8	1.29	3.0
Humbolt	80	7	37.8	1.09	
Independence	84	14	40.6	1.81	3.0
Indianola	87	15	43.2	1.50	5.6
Inwood	76	7	36.4	0.51	2.7
Iowa City	86	19	42.4	1.59	2.0
Iowa Falls	84	1	37.8	1.97	5.5
Iowa—Cont'd.					
Jefferson	88	10	42.0	1.26	2.0
Keosauqua	88	21	44.7	2.38	8.0
Lacena				1.66	
Larrabee	82	2	37.2	0.30	1.6
Ledlake				1.83	4.0
Lemars	78	3	37.2	0.50	1.0
Lenox	87	17	44.0	1.76	4.3
Leon	86	18	44.4	0.94	5.0
Little Sioux	88	8	42.0	0.54	4.2
Logan	89	11	41.9	0.54	4.0
Maple Valley				0.46	3.7
Marshalltown	87	5	39.2	3.22	4.0
Mason City	82	8	37.2	1.57	3.5
Massena	92	10	43.0	0.54	2.0
Mountair	90	17	44.8	2.92	6.8
Mount Pleasant	86	20	45.0	2.70	6.4
Mount Vernon	83	16	41.8	2.04	3.2
Muscataine				1.65	3.5
Nevada				0.77	3.2
New Hampton	80	5	36.2	1.90	5.5
Newton	86	13	42.1	0.90	4.0
Northwood	80	5	35.2	2.70	7.5
Odebolt	86	12	40.1	0.26	0.5
Olin	81	18	42.1	2.18	2.0
Onawa	88	9	41.8	0.45	3.2
Osage	82	8	36.1	1.32	2.0
Oskaloosa	87	16	43.8	0.76	4.4
Ottumwa	88	21	46.6	1.68	3.5
Pacific Junction	91	8	43.7	0.66	4.8
Pella	88	16	43.9	0.96	3.6
Perry	89	8	41.4	1.13	4.1
Plover	84	5	36.0	0.40	3.5
Pocahontas	87	8	37.4	0.63	4.8
Ridgeway	83	10	37.4	2.90	5.1
Rock Rapids	76	2	37.2	0.80	4.0
Rockwell	86	9	40.8	0.60	3.0
Sac City	82	12	38.6	0.48	2.0
St. Charles	90	17	43.8	2.18	6.1
Sheldon	80	4	37.2	0.62	3.5
Sibley	78	4	31.8	0.61	4.6
Sigourney	86	18	44.0	1.29	5.0
Sioux Center	74	3	36.2	0.33	2.5
Stockport	87	20	45.4	1.39	7.0
Storm Lake	82	8	37.2	0.95	2.0
Stuart	85	14	40.7	0.46	4.5
Thurman	90	8	43.4	0.70	0.8
Tipton	83	19	44.0	2.14	
Toledo	86	10	41.4	1.35	2.5
Wapello	85	22	44.4	1.55	1.2
Washington	86	18	43.4	2.62	
Washita	86	1	38.2	0.23	0.5
Waterloo	86	3	40.4	2.26	3.0
Waukegan	86	11	41.4	1.27	4.6
Waverly	84	5	39.0	1.72	5.0
Webster City	35	3	39.9	1.94	4.5
Westend	83	2	36.2	0.57	4.3
Whitten	84	4	39.6	0.79	3.0
Wilton Junction	81	18	44.0	1.68	0.2
Winterset	87	15	44.8	1.96	4.5
Woodburn	88	15	43.6	3.52	13.0
Zealand	87	8	39.5	1.45	2.7
Kansas.					
Abilene				1.18	
Alton	99	8	50.4	0.72	6.0
Anthony	98	22	57.0	0.69	
Atchison	91	19	50.3	2.39	1.0
Baker	91	17	48.3	1.05	0.5
Beloit				1.14	4.0
Blue Rapids				1.42	2.5
Burlington	94	23	56.0	1.33	
Chapman	94	16	53.3	1.28	T.
Cimarron	100	13	50.9	0.15	T.
Clay Center	93	13	50.9	1.16	0.3
Colby	94	12	48.8	0.69	6.2
Coldwater	98	16	54.2	0.04	
Columbus	90	28	56.1	2.32	
Coollidge	93	10	50.2	T.	
Cottonwood Falls	94	18	54.2	1.39	
Cunningham	98	19	54.4	0.50	
Dresden	92	10	47.4	0.63	7.0
Eldorado	92	20	54.6	0.92	
Ellinwood	97	16	52.8	0.81	T.
Ellsworth	98	12	51.8	0.92	
Emporia	93	20	55.4	1.94	
Englewood	100	16	56.0	0.21	T.
Enterprise	95	16	53.0	1.17	T.
Eskridge	90	16	51.3	1.12	
Eureka				1.20	
Fall River	94	25	56.6	2.85	T.
Farnsworth	97	11	48.8	0.77	T.
Forest Hill	94	13	49.2	0.83	2.5
Fort Scott	95	26	57.2	2.01	
Frankfort	95	15	49.8	1.50	4.2
Garden City	98	15	52.0	0.48	T.
Garnett	92	21	55.4	3.23	
Goodland	90	11	48.8	0.43	3.0
Greensburg	95	12	51.4	0.01	
Grenola	94	24	55.6	1.93	
Kansas—Cont'd.					
Hanover	94	12	49.1	0.60	3.5
Harrison	96	5	46.9	1.25	9.5
Hays	97	16	49.8	0.85	T.
Hill City	93	20	48.0	0.71	3.8

TABLE II.—Climatological record of cooperative observers—Continued.

Stations.	Temperature. (Fahrenheit.)			Precipitation.	
	Maximum.	Minimum.	Mean.	Rain and melted snow.	Total depth of snow.
<b>Kentucky—Cont'd.</b>	°	°	°	Inch.	Inch.
Williamsburg	90	18	55.0	2.70	4.2
Williamstown	86	21	49.4	5.32	
<b>Louisiana.</b>					
Abbeville	93	44	70.5	0.59	
Alexandria	93	39	71.0	2.05	
Amite	90	41	70.0	1.19	
Baton Rouge	86	42	70.7	0.73	
Burnside	87	43	69.3	1.65	
Calhoun	87	35	66.0	5.61	
Cameron	83	49	71.4	1.61	
Cheneyville	92	40	70.4	1.23	
Clinton	87	40	70.0	1.21	
Collinston	88	39	67.2	5.80	
Covington	89	44	69.8	3.94	
Donaldsonville	94	46	71.8	1.03	
Farmerville	89	36	67.4	3.93	
Franklin	92	45	71.9	0.86	
Grand Coteau	90	45	71.4	0.64	
Houma	86	43	69.2	0.84	
Jennings	88	42	69.5	1.64	
Lafayette	88	43	70.0	0.39	
Lakeside	87	41	70.1	1.62	
Lawrence	88	50	70.3	0.98	
Libertyville	90	35	68.2	5.90	
Logansport	89	48	69.6	1.10	
Meville	89	40	69.0	3.02	
Minden	89	40	69.0	4.32	
Monroe	89	40	69.0	1.12	
Morgan City	89	48	71.0	0.80	
New Iberia	85	35	70.8	1.08	
Opelousas	88	32	67.6	3.29	
Plain Dealing	90	45	70.6	0.71	
Rayne	89	34	66.4	1.32	
Robeline	88	38	66.6	7.25	
Ruston	89	45	70.0	1.00	
St. Francisville	91	44	70.3	1.00	
Schriever	89	44	70.3	2.04	
Simmesport	86	48	69.9	1.63	
Southern University	86	43	70.4	1.83	
Sugar Experiment Station	86	43	70.4	1.83	
Sugartown	86	43	70.4	1.83	
West Pearl River	86	43	70.4	1.83	
<b>Maine.</b>					
Bar Harbor	59	-3	30.0	2.00	11.5
Cornish	61	0	31.0	3.03	18.5
Danforth	60	-10	26.4	2.87	2.5
Debsconeg	60	-20	27.6	2.80	28.0
Fairfield	64	-20	28.0	1.43	7.0
Farmington	64	-20	28.0	2.88	15.0
Gardiner	64	-23	28.4	2.09	13.0
Lewiston	61	-13	28.9	3.05	19.1
Madison	60	-20	25.6	1.84	13.0
Mayfield	55	-4	28.4	1.86	12.0
Millinocket	60	-16	26.5	2.16	17.8
Oquassoc	58	-22	25.6	2.86	33.0
Orono	60	-25	27.2	2.25	15.5
Patten	44	-16	19.4	1.40	14.0
Rumford Falls	58	-12	28.4	2.90	22.0
The Forks	58	-12	28.4	2.96	21.5
Van Buren	55	-32	21.1	3.20	19.5
Winslow	62	-20	27.4	1.72	9.0
<b>Maryland.</b>					
Annapolis	76	22	46.4	3.45	7.5
Bachmans Valley	85	15	42.8	2.02	6.0
Cambridge	91	20	49.0	2.87	3.8
Cheltenham	91	20	47.0	2.61	2.0
Chestertown	82	20	45.2	2.77	6.7
Cheswille	88	17	44.6	2.94	5.0
Clearspring	90	14	43.6	4.90	10.5
Coleman	87	20	45.6	3.34	7.5
Collegepark (Md. Ex. Sta.)	91	15	47.8	2.20	5.3
Cumberland	90	12	48.5	3.45	6.0
Darlington	85	15	43.0	2.79	8.0
Deerpark	81	3	41.4	7.05	16.0
Denton	91	17	47.0	2.35	2.5
Easton	86	20	46.9	3.32	4.6
Fallston	84	15	43.8	3.57	9.0
Frederick	90	20	46.5	3.25	8.0
Frostburg	88	15	46.5	3.25	8.0
Grantville	78	8	41.4	5.48	9.8
Great Falls	91	16	47.4	2.53	3.8
Greenspring Furnace	90	17	45.9	4.29	9.5
Harney	88	20	47.6	3.53	8.5
Jewell	88	20	47.6	2.53	4.0
Keedysville	91	19	46.9	3.32	8.0
Lake Montebello	90	15	46.2	2.59	7.0
Laurel	89	16	45.8	2.33	5.0
Monrovia	89	22	48.8	5.78	12.5
Mount St. Marys College	80	2	42.8	3.45	9.0
Oakland	77	19	44.4	1.88	
Pocomoke City	88	21	49.2	2.98	T.
Portobello	92	22	49.4	2.11	1.5
Princess Anne	89	19	47.4	2.38	1.0
Salisbury	93	19	48.2	1.99	0.1
Solomons	89	23	46.6	3.01	0.4
Sudlersville	90	18	46.2	2.58	5.7
Takoma Park	91	18	46.0	2.70	6.0
<b>Maryland—Cont'd.</b>					
Taneytown	87	13	43.6	3.04	8.6
Van Bibber	80	18	44.5	3.52	7.3
Westernport	89	18	46.1	5.07	9.2
Woodstock	84	20	46.8	1.95	6.5
<b>Massachusetts.</b>					
Amherst	80	6	35.2	1.82	3.0
Bedford	69	6	33.8	1.86	5.5
Bluehill (summit)	70	9	34.9	2.62	12.6
Chestnut Hill	72	7	37.5	2.44	6.0
Concord	76	-2	34.6	1.99	4.9
Fitchburg	80	2	35.4	1.68	5.2
Framingham	76	4	35.7	1.79	3.8
Groton	75	1	34.2	2.00	7.5
Hyannis	69	16	36.4	2.66	12.6
Jefferson	72	-6	34.3	1.87	8.5
Lawrence	72	-6	34.3	1.97	6.8
Leominster	74	-2	35.2	1.84	5.2
Lowell	76	-2	35.2	2.15	
Middleboro	76	6	36.2	2.17	5.1
Monson	79	4	36.1	1.61	5.5
New Bedford	73	16	37.6		
Pittsfield	70	10	36.6	1.13	1.0
Plymouth	70	10	36.6	2.33	6.0
Princeton	67	20	37.6	1.51	5.0
Provincetown	67	20	37.6	1.55	8.5
Salem	78	8	38.1	2.18	8.0
Somerset	78	8	38.1	1.33	7.0
Sterling	76	1	36.3	1.85	6.2
Taunton	76	1	36.3	2.06	
Webster	82	1	38.0	1.74	7.0
Westboro	82	1	38.0	1.68	5.2
Weston	70	7	35.2	1.72	6.2
Williamstown	75	5	34.2	1.56	1.5
Winchendon	79	12	36.9	1.58	5.5
Worcester	79	12	36.9	1.37	3.7
<b>Michigan.</b>					
Adrian	79	11	40.5	3.23	2.0
Agricultural College	75	10	38.6	2.84	3.0
Allegan	76	10	39.2		T.
Alma	70	5	36.2	2.30	6.5
Ann Arbor	71	11	37.6	2.24	3.4
Arbela	70	8	37.4	3.54	4.0
Ball Mountain	74	8	36.2	2.53	2.9
Baraga	77	12	40.7	1.60	5.0
Battle Creek	77	12	40.7	5.55	1.0
Bay City	70	7	35.4	2.45	6.0
Benzonis	65	9	34.6		
Berlin	73	5	35.3	2.72	3.9
Big Rapids	66	2	34.5	4.01	3.0
Blaney	58	-9	28.0	0.55	5.5
Bloomington	82	10	41.3	2.98	1.0
Calumet	50	-2	24.6	2.51	16.5
Cassopolis	85	12	42.2	6.00	T.
Charlevoix	62	1	31.2	1.20	6.0
Charlotte	79	9	39.6	1.47	
Chatham	60	-17	26.1	1.27	7.2
Cheboygan	60	-9	30.7	2.47	3.5
Clinton	75	12	38.8	2.90	2.0
Coldwater	78	11	42.2	3.54	1.0
Concord	75	11	39.8	4.42	T.
Deer Park	53	-8	27.0	1.05	T.
Dundee	82	12	40.4	2.91	2.5
Eagle Harbor	82	-7	26.2	2.83	22.8
East Tawas	70	4	33.7	3.45	5.5
Elkton	76	10	39.8	1.76	3.5
Flint	70	10	37.4	2.76	3.0
Frankfort	61	12	34.6	2.15	6.0
Grand Marais	83	-7	27.2	1.16	10.1
Grape	76	13	40.4	2.36	1.0
Grass Lake	76	10	39.1	2.25	T.
Grayling	67	-6	30.2	2.05	11.0
Hagar	83	20	41.0	7.36	T.
Harbert	85	18	43.4		
Harbor Beach	77	5	35.0		
Harrison	66	0	32.4	3.75	7.0
Harrisville	70	4	33.3	3.32	10.0
Hayes	69	8	34.6	2.87	7.0
Highland	78	11	39.3	2.77	6.2
Hillsdale	74	13	39.4	3.14	1.9
Holland	78	9	38.0	1.86	2.5
Howell	78	9	38.0	2.80	2.0
Humboldt	50	-24	23.4	1.00	7.5
Iron Mountain	61	-8	29.4	1.03	6.0
Iron River	57	-16	26.7	3.90	8.0
Ironwood	53	-1	27.2	1.10	9.0
Ishpeming	67	-8	31.2	0.70	6.0
Ivan	67	-8	31.2	1.79	6.5
Jackson	79	13	40.4	2.88	1.0
Jeddo	68	7	34.9	3.57	11.4
Kalamazoo	79	14	41.0	2.38	1.0
Lansing	77	12	39.0	3.28	3.2
Lapeer	70	7	36.8	1.43	2.0
Ludington	64	-6	36.4	2.79	1.0
Mackinaw	55	-1	29.1	0.75	7.5
Mancelona	62	-7	31.2	1.37	T.
Maple Ridge	57	-15	27.2	1.75	4.0
Marlboro	65	-10	33.4	3.84	3.0
Menominee	65	5	32.8	1.38	8.0
<b>Michigan—Cont'd.</b>					
Montague	72	9	35.9	3.55	2.0
Mount Clemens	64	9	35.4	1.72	2.0
Mount Pleasant	73	7	36.4	3.15	
Muskegon	63	2	31.4	3.47	2.0
Old Mission	75	12	39.0	1.69	5.7
Olivet	68	3	32.5	4.28	2.1
Omer	68	3	32.5	2.90	T.
Owosso	60	-3	30.0	2.47	0.5
Petoskey	75	8	38.6	1.00	9.0
Plymouth	76	11	35.8	2.40	3.0
Port Austin	61	-4	27.1	1.14	2.0
Powers	65	1	33.8	6.0	
Reed City	73	9	37.0	1.59	2.0
Saginaw (W. S.)	69	9	35.0	3.11	7.6
St. Johns	80	17	40.2	3.87	
St. Joseph	76	4	37.9	2.83	1.8
Saranac	70	12	37.4	2.60	T.
South Haven	62	8	35.1	2.00	7.0
Stanton	54	-6	29.5	1.90	17.0
Thornville	71	9	37.4	3.61	6.0
Traverse City	65	2	34.2	2.30	6.0
Vassar	80	14	41.2	4.20	12.0
Wasiepi	75	10	38.9	5.06	2.0
Webberville	75	10	38.9	2.62	2.5
West Branch	60	-18	25.3	2.90	12.0
Wetmore	54	-2	24.8	1.40	12.0
Whitefish Point	61	-9	27.8	1.56	6.4
Woodlawn	61	-9	27.8	3.78	17.0
Ypsilanti	78	10	39.0	2.87	3.3
<b>Minnesota.</b>					
Albert Lea	83	2	33.6	1.15	1.0
Alexandria	58	-6	24.0	0.92	0.8
Angus	48	-12	18.6		
Bagley	54	-24	21.5	0.90	9.0
Beardsley	74	-5	32.6	0.15	1.5
Beaulieu	55	-12	22.2	0.45	6.0
Bird Island	66</				

TABLE II.—Climatological record of cooperative observers—Continued.

Temperature. (Fahrenheit.)						Precipitation.		Temperature. (Fahrenheit.)						Precipitation.		Temperature. (Fahrenheit.)						Precipitation.																																																																																																																																																																																																																																																																
Maximum.			Minimum.			Mean.			Rain and melted snow.	Total depth of snow.	Maximum.			Minimum.			Mean.			Rain and melted snow.	Total depth of snow.	Maximum.			Minimum.			Mean.			Rain and melted snow.	Total depth of snow.																																																																																																																																																																																																																																																						
Stations.	Maximum.	Minimum.	Mean.	Stations.	Maximum.	Minimum.	Mean.	Stations.			Maximum.	Minimum.	Mean.	Stations.	Maximum.	Minimum.	Mean.	Stations.	Maximum.			Minimum.	Mean.																																																																																																																																																																																																																																																															
Mississippi—Cont'd.										Missouri—Cont'd.										Montana—Cont'd.																																																																																																																																																																																																																																																																		
Austin	88	34	64.4	6.65	Jackson	88	28	58.2	3.28	Raymond					1.54	7.1	Red Lodge	66	7	33.2	1.09	9.0	Saltese	65	12	35.7	1.25	3.4																																																																																																																																																																																																																																																										
Batesville	92	34	64.0	5.54	Jefferson City	93	26	51.6	2.90	Renovo					4.22	34.0	Snowshoe	60	10	28.4	6.74	47.5	Springbrook	63	—	28.2	2.14	20.1																																																																																																																																																																																																																																																										
Bay St. Louis	85	47	70.0	1.74	Joplin	94	28	59.4	2.46	Steele	69	6	34.4	1.70	10.4	Tokna	64	—	27.9	0.95	8.0	Tosten	67	8	35.1	0.61	T.																																																																																																																																																																																																																																																											
Bellefontaine	87	50	71.2	1.58	Kidder	88	23	48.6	2.50	Troy	60	22	39.2	3.35		Twin Bridges	64	12	35.6	0.80	5.0	Utica	62	5	32.5	0.61	3.0																																																																																																																																																																																																																																																											
Biloxi	84	35	62.0	4.80	Koshkonong	92	30	57.6	1.39	Wolf Creek	66	4	33.7	0.42	3.9	Agate	79	—	40.5	0.50	5.0	Alinsworth	85	—	41.9	0.65	5.2																																																																																																																																																																																																																																																											
Booneville	87	40	67.9	1.10	Lamar	93	29	57.2	1.57							Albion	87	—	39.6	0.20	2.0	Alliance	78	9	41.0	0.20	2.0																																																																																																																																																																																																																																																											
Brookhaven	91	40	67.9	1.10	Lamonte				3.77							Alma	97	8	46.4	0.86	7.5	Anoka					0.14	1.0																																																																																																																																																																																																																																																										
Canton	89	38	66.5	1.72	Lebanon	90	30	55.4	1.86							Arapahoe					0.80	8.0	Arcadia					0.30	3.0																																																																																																																																																																																																																																																									
Clarkdale	93	33	65.4	2.23	Lexington	89	25	51.4	3.42							Ashland	91	10	44.6	0.39	3.8	Ashton					0.01	T.																																																																																																																																																																																																																																																										
Columbia				1.10	Liberty	90	24	51.6	2.57							Atkinson	85	—	39.8	0.90	9.0	Auburn	93	15	47.8	1.15	6.0																																																																																																																																																																																																																																																											
Columbus	91	38	64.8	2.25	Lockwood	91	29	56.8	2.15							Aurora	90	6	43.8	0.05	0.5	Beatrice	88	12	46.8	1.08	8.0																																																																																																																																																																																																																																																											
Corinth	85	37	60.6	7.12	Louisiana	94	25	51.8	4.04							Beaver	92	9	46.3	0.85	8.0	Bellevue	92	12	44.6	0.22	1.5																																																																																																																																																																																																																																																											
Crystal Springs	88	38	67.0	2.82	Marblehill	89	25	56.9	3.41							Burkhard					0.60	6.0	Burwell					T.	T.																																																																																																																																																																																																																																																									
Duck Hill	89	33	65.6	3.61	Marshall	90	25	51.9	2.59							Callaway	87	1	44.0		0.60	6.0	Chester					0.50	5.0																																																																																																																																																																																																																																																									
Edwards	88	40	68.0	1.87	Maryville	92	18	45.2	2.98							Cody					0.50	5.0	Columbus	90	5	41.2	0.11	1.2																																																																																																																																																																																																																																																										
Enterprise				5.36	Mexico	92	25	50.0	3.28							Crete	90	9	45.4	0.52	4.2	Culbertson					0.38	6.0																																																																																																																																																																																																																																																										
Fayette	86	36	67.0		Monroe	89	24	48.8	2.58							David City	86	5	42.0	0.26	2.0	Dawson	95	15	48.4	0.74	6.0																																																																																																																																																																																																																																																											
Fayette (near)				2.22	Mountain Grove	86	22	53.4	2.87							Dubois					0.64	5.8	Duff					0.50	5.0																																																																																																																																																																																																																																																									
Greenville	91	37	66.4	6.14	Mount Vernon	91	25	57.4	5.68							Dunning					0.50	5.0	Edgar					0.55	5.5																																																																																																																																																																																																																																																									
Greenwood	92	38	65.7	8.10	New Madrid	93	29	59.1	3.20							Ellis					0.93	8.0	Ewing	86	—	38.0	0.70	6.5																																																																																																																																																																																																																																																										
Hattiesburg	91	43	65.4	3.68	Neosho				2.94							Fairbury	93	10	47.3	0.76	7.0	Fairmont	90	0	42.9	0.44	6.0																																																																																																																																																																																																																																																											
Hazlehurst	88	41	67.3	3.25	New Palestine	90	29	54.3	3.69							Fort Robinson	81	6	41.7	1.90	9.6	Franklin	96	12	46.2	0.71	7.1																																																																																																																																																																																																																																																											
Hernando	87	30	60.0	5.85	Oakfield	92	28	53.6	2.47							Fremont	89	8	41.9	0.35	3.5	Fullerton	87	16	42.5	0.24	2.0																																																																																																																																																																																																																																																											
Holly Springs	86	33	60.4	5.43	Olden	91	28	58.6	4.17							Geneva	91	2	45.2	0.61	6.1	Genoa (near)	88	6	42.4	0.30	2.0																																																																																																																																																																																																																																																											
Indianola	86	39	64.0	9.90	Oregon	90	16	47.8	1.15							Gering					0.23	1.0	Gosper					0.35	4.0																																																																																																																																																																																																																																																									
Jackson	89	40	67.4	2.62	Oscola				3.25							Gothenburg	89	4	44.6	0.10	1.0	Grand Island	90	8	44.4	T.	T.	T.																																																																																																																																																																																																																																																										
Kosciusko	88	36	64.8	2.34	Rolla				2.22							Grant	85	7	44.3	0.40	4.0	Guide Rock					0.88	8.5																																																																																																																																																																																																																																																										
Lake	91	33	66.6	3.06	St. Charles	92	28	52.4	1.94							Haigler					0.10	1.0	Halsey	85	3	42.7	0.29	3.2																																																																																																																																																																																																																																																										
Lake Como	91	38	67.2	2.68	St. Joseph				2.16							Harvard	83	0	39.8	0.08	0.5	Hartington	83	0	39.8	0.08	0.5																																																																																																																																																																																																																																																											
Laurel	90	38	67.9	1.81	Sarcozie				2.31							Hastings	88	10	44.0	0.62	5.5	Hayes Center	88	13	45.4	0.56	5.0																																																																																																																																																																																																																																																											
Leakesville	91	42	68.0	6.79	Sedalia	90	25	53.7	4.06							Hay Springs	83	—	41.6	0.41	3.0	Hebron	91	5	46.4	0.92	8.0																																																																																																																																																																																																																																																											
Louisville	88	36	63.8	2.68	Seymour	88	26	55.6	3.10							Hendley					1.20	12.0	Holdrege	92	9	46.4	0.40	4.0																																																																																																																																																																																																																																																										
McNeill	90	41	68.3	1.22	Sikeston	88	28	58.4	3.01							Hooper	68	10	40.8	0.26	2.3	Hooper	68	10	40.8	0.26	2.3																																																																																																																																																																																																																																																											
Macon	92	37	65.1	2.22	Stikeston	88	28	58.4	3.01							Imperial	87	10	46.4	0.30	2.2	Kennedy	84	—	42.2	0.74	2.0																																																																																																																																																																																																																																																											
Magee	89	34	65.5	1.62	Steffenville	90	25	49.4	4.38							Kimbball	82	7	44.0	0.60	6.0	Kirkwood	88	—	42.6	0.54	6.0																																																																																																																																																																																																																																																											
Magnolia	89	38	68.8	1.81	Sublett	85	22	46.6	2.55							Lexvitt					0.15	1.5	Lexington	85	9	44.8	0.80	8.0																																																																																																																																																																																																																																																										
Merrill				9.98	Trenton	85	23	47.5	1.45							Lodgepole	87	—	42.2	0.10	2.0	Loup	93	—	42.8	0.29	2.0																																																																																																																																																																																																																																																											
Natchez	89	39	69.1	1.91	Unionville	86	18	44.6	1.80							Lynch					0.45	4.0	McCook					0.30	3.0																																																																																																																																																																																																																																																									
Okolona	88	36	63.8	2.51	Warrensburg	91	24	54.2	3.77							Madison	88	2	41.4	0.30	3.0	Marquette					0.12	1.0																																																																																																																																																																																																																																																										
Pearlington	88	39	70.0	1.55	Warrenton	92	26	50.8	2.32							Mason					0.20	2.0	Merriman					0.20	2.0																																																																																																																																																																																																																																																									
Pecan	87	47	68.6	2.89	Warsaw	93	23	55.8	3.50							Minden	92	6	43.8	0.62	7.0	Monroe	92	15	45.3	0.30	3.0																																																																																																																																																																																																																																																											
Pittsboro	88	35	63.6	3.53	Wheatland				2.61							Nemaha					0.27	1.5	Nebraska City					0.70	7.0																																																																																																																																																																																																																																																									
Pontotoc	89	35	63.2	3.88	Windsor	91	23	53.5	5.03							Norfolk	91	0	41.4	0.41	4.0	Norfolk					0.30	3.0																																																																																																																																																																																																																																																										
Porterville	91	34	65.6	1.64	Montana.																																																																																																																																																																																																																																																																																	

TABLE II.—Climatological record of cooperative observers—Continued.

Stations.	Temperature. (Fahrenheit.)			Precipitation.	
	Maximum.	Minimum.	Mean.	Rain and melted snow.	Total depth of snow.
Nebraska—Cont'd.					
North Loup	89	0	42.3	0.15	1.5
Oakdale	85	-3	38.8	0.40	2.6
Oakland	88	11	41.5	0.40	
Ord				0.18	
Oscola	88	7	43.5	0.00	
Palmer				0.05	0.5
Palmyra	92	12	44.7	0.50	3.0
Pawnee City	95	15	47.9	0.95	7.0
Plattsmouth				0.42	4.0
Plymouth	91	12	47.1	0.80	8.0
Purdum	80	3	41.8	1.02	10.0
Ravenna	89	2	43.0	0.20	2.0
Redcloud	98	18	47.2	T.	
Republican				0.80	8.0
St. Libory				0.20	2.0
St. Paul	88	3	42.7	0.14	1.4
Santee	91	1	42.4	0.21	T.
Schuyler				0.30	3.0
Scottsbluff	85	-2	42.2	0.05	1.8
Seward	89	20	44.6	0.05	0.5
Springview	86	0	40.9	0.60	6.0
Stanton	89	1	40.5	0.35	3.5
Strang				0.80	8.0
Stratton				0.20	2.0
Superior	101	5	48.4	1.00	10.0
Syracuse				0.30	3.0
Tablerock				1.00	7.0
Tecumseh	94	12	48.9	0.80	4.0
Tekamah	89	8	42.6	0.47	4.0
Turlington	91	13	45.1	0.71	6.5
University Farm	91	10	44.5	0.46	4.0
Wahoo				0.10	1.0
Wakefield	85	-1	38.6	0.60	4.3
Watertown				0.15	1.5
Wauneta				0.60	6.0
Weeping Water				1.09	3.5
Westpoint	88	3	40.8	0.10	1.0
Wilber				0.30	3.0
Wilsonville				0.50	5.0
Winnebago	85	-3	38.4	0.12	2.5
Wisner				0.14	2.8
Wymore				0.60	6.0
York	89	4	43.2	0.30	3.0
Nevada.					
Amos	65	18	32.9	1.95	
Aura	56	1	30.6	6.18	45.5
Battle Mountain	58	20	37.9	0.61	6.1
Carlin	42	-5	31.9	2.00	16.0
Carson Dam	70	21	42.6		
Clover Valley	62	3	37.8	2.58	12.0
Columbia				2.22	3.0
Dyer	77	1	36.2		
Elko	62	8	37.0	1.86	13.6
Eureka	62	4	36.6	2.18	19.0
Fallon	70	12	42.4	1.40	2.5
Fernley	65	22	41.2	1.37	0.9
Geyser	64	7	35.6	2.08	1.5
Golconda	67	20	41.6	1.52	
Halleck				0.77	7.7
Hamilton	50	-10	26.4	4.70	47.0
Hazen	70	20	42.2	1.31	3.5
Humboldt	64	23	41.3	0.75	
Leetville	75	21	42.8	0.12	0.8
Lewers Ranch	76	11	37.5	16.85	41.0
Logan	83	31	56.8	1.40	
Mill City	64	26	36.1	0.65	6.0
Mina	67	19	43.0	0.20	2.0
Palmetto	64	9	34.9	8.00	48.0
Paradise Valley				3.10	8.2
Pioche	71	11	39.2	2.64	8.5
Potts	60	-4	33.2	1.60	13.0
San Jacinto	66	-5	37.0	2.40	19.4
Tecoma	70	15	37.5	0.05	T.
Verdi	62	2	34.9	3.90	39.0
Wabuska	72	11	41.1	1.25	
New Hampshire.					
Alstead	68	-1	31.1	1.86	11.0
Bartlett				4.56	29.0
Bethlehem	59	-8	27.0	2.41	14.0
Brookline	70	-8	34.1	1.85	6.8
Durham	66	0	34.2	1.32	11.5
Franklin Falls	69	-7	30.9	2.18	14.0
Grafton	62	-16	28.0	2.12	13.0
Groveton				2.93	17.8
Hanover	63	-13	30.8	2.08	10.0
Keene	79	-9	32.3	1.68	6.0
Nashua	75	-2	33.6	1.80	8.5
Newton	70	-5	32.6	1.60	5.0
Plymouth	64	-9	29.8	2.85	12.2
New Jersey.					
Asbury Park	76	13	40.4	3.19	14.0
Bayonne	77	11	39.6	3.37	13.0
Belvidere	84	5	40.4	3.22	9.5
Bergen Point	78	14	40.0	2.39	12.0
Beverly	88	11	42.4	2.98	9.8
Bridgeton	85	15	45.0	3.66	8.5
Canton				3.12	6.2
Cape May C. H.	81	15	44.8	2.96	10.7
New Jersey—Cont'd.					
Charlottesville	77	-5	38.2	2.41	10.0
Clayton	87	12	43.6	2.60	11.0
College Farm	79	5	40.4	3.29	12.5
Dover	77	6	37.4	3.31	13.0
Elizabeth	76	14	41.0	3.08	13.0
Englewood	72	13	39.3	4.38	17.0
Flemington	85	8	40.4	3.82	12.0
Friesburg	85	14	43.8	2.70	7.6
Hightstown	81	10	40.4	3.44	8.0
Imlaystown	84	10	41.2	2.58	8.8
Indian Mills	84	9	43.3	2.93	12.4
Jersey City	79	13	41.0	3.55	14.6
Lakewood	80	10	43.1	2.93	10.0
Lambertville	87	11	42.0	3.10	12.5
Layton	82	-9	36.4	2.50	9.3
Moorestown	86	11	42.0	2.66	13.0
Newark	78	10	40.6	4.31	13.2
New Brunswick	79	3	39.6	4.15	17.0
Newton	82	-1	38.3	2.56	10.0
Oceanic	78	16	41.4	3.32	10.5
Paterson	79	10	41.8	3.05	14.5
Phillipsburg	85	11	40.6	3.16	13.7
Plainfield	79	12	40.0	3.17	12.5
Pleasantville				1.81	
Rancocas				3.91	12.3
Somerville	80	9	40.6	2.72	13.5
South Orange	75	13	40.0	3.39	12.0
Sussex	83	-3	38.8	2.37	12.0
Toms River	80	6	40.6	2.30	15.5
Trenton	83	16	43.8	2.65	6.0
Tuckerton	80	8	41.8	3.06	9.0
Vineland	85	12	44.0	2.44	7.8
Woodbine	81	12	44.2	3.85	8.0
New Mexico.					
Alamogordo	90	26	57.6	T.	
Albert	92	19	54.4	0.00	
Albuquerque	85	21	53.9	0.00	
Alto				0.22	
Artesia	92	25	58.2	0.12	
Bellfranch	92	13	52.7	0.00	
Bloomfield	89	11	45.5	0.30	1.0
Cambray				0.00	
Carlsbad	97	29	61.4	T.	
Chama	72	0	36.6	0.94	6.0
Cimarron	81	9	47.5	T.	
Cliff	91	19	52.3	0.08	
Cloudcroft	70	13	40.5	1.50	3.0
Datil	93	10	44.1	0.00	
Deming	87	32	52.5	0.06	
Dorsey	83	12	48.6	0.01	
Dulce	77	11	40.4	1.44	6.5
Eagle Rock Ranch	82	14	46.4	T.	T.
Elizabethtown	66	8	38.5	0.55	2.0
Elk	88	23	54.6	T.	
El Vado	85	11	39.8	1.23	0.5
Engle				0.00	
Espanola	81	13	47.3	T.	
Estancia	80	10	44.2	0.00	
Fairview				0.00	
Fort Bayard	85	20	52.0	0.15	
Fort Stanton	84	16	49.4	T.	
Fort Union	81	8	44.1	0.08	
Fort Wingate	78	14	44.4	0.63	1.7
Frisco	85	20	49.3	0.47	
Fruitland	83	13	47.4	0.14	
Gage				0.15	
Glen	94	22	56.2	T.	
Hillsboro	87	25	54.6	T.	
Hope				0.00	
Laguna	83	11	48.0	0.00	
Lagunita	90	21	51.5	T.	
Lake Valley				T.	
Las Vegas	82	10	47.6	0.07	T.
Lordsburg	93	24	55.1	0.00	
Los Alamos				0.02	
Los Lunas	87	19	49.7	0.08	
Luna	76	10	41.4	0.30	
Magdalena	84	12	48.0	0.00	
Manuelito				0.92	
Mesilla Park	89	20	57.8	0.05	
Mimbres				0.00	
Mineral Hill				0.25	0.5
Monument	95	25	60.6	0.00	
Mountain Air	83	22	49.8	0.06	T.
Nara Visa	92	25	56.2	T.	
Orange	95	29	56.9	0.00	
Red River				1.00	9.0
Redrock				0.03	
Rincon	92	22	56.2	T.	
Rociada	75	7	43.6	0.33	
Rosa				0.60	
Rosedale	78	15	48.4	0.05	
San Marcial	89	24	55.4	0.00	
San Rafael	83	16	47.2	0.00	
Socorro	91	24	53.0	0.00	
Springer	90	10	46.4	0.00	
Strauss				T.	
Taos	80	14	45.1	0.62	
New Mexico—Cont'd.					
Tres Piedras	71	6	38.4	0.30	
Tucumcari	92	22	57.8	0.00	
Valley				T.	
Vernicejo	72	16	43.0	T.	
Winters	74	11	39.2	0.61	
New York.					
Adams	74	8	38.0	1.23	2.0
Addison	83	-3	39.0	0.90	7.5
Allegany	79	-6	38.6	3.65	11.6
Amsterdam	71	4	33.0	2.48	2.0
Angelica	95	-9	33.9	2.15	7.0
Appleton	70	4	36.2	2.30	2.6
Athens	78	8	37.3	0.77	1.5
Atlanta	84	-7	34.0	1.33	
Atwater				0.94	2.6
Auburn	80	-2	36.		

TABLE II.—Climatological record of cooperative observers—Continued.

Stations.	Temperature. (Fahrenheit.)			Precipitation.	
	Maximum.	Minimum.	Mean.	Rain and melted snow.	Total depth of snow.
New York—Cont'd.					
Waverly	84	7	38.4	1.29	6.3
Wedgwood	79	2	36.2	1.53	7.5
West Berns.	75	0	35.3	0.97	1.0
Westfield.	77	8	37.2	2.68	3.0
Westpoint.	72	0	38.8	2.30	14.0
Windham	77	-10	35.4	0.89	1.3
Youngstown				2.17	3.5
North Carolina.					
Battleboro				3.45	0.5
Beaufort.	83	32	56.8	2.73	T.
Brevard.	87	28	55.6	3.77	
Brewers.	93	23	52.0	2.33	3.0
Bryson City				3.76	
Buck Springs.	76	16	45.8	2.40	
Caroleen.	94	29	57.9	3.21	0.6
Chalybeate Springs.	95	23	55.6	4.75	1.5
Chapel Hill.	92	28	54.9	1.50	T.
Clinton.	93	30	59.8	5.68	0.8
Eagletown.	93	25	55.1	4.45	
Edenton.	90	29	55.7	1.91	T.
Fayetteville.	97	27	59.6	1.85	
Goldstoro.	96	22	55.2	3.54	1.5
Graham.				2.83	1.0
Greensboro.	93	28	53.4	2.21	0.5
Greenville.				4.31	2.0
Henderson.	92	26	54.3	3.51	
Hendersonville.	88	30	54.8	4.39	T.
Horse Cove.	84	31	56.0	3.15	
Hot Springs.	88	32	56.4	2.39	
Kinston.	98	25	59.2	2.08	
Lenoir.	93	26	54.6	3.81	T.
Lexington.	92	27	54.7		
Lincolnton.	93	22	57.1	3.13	2.0
Louisburg.	92	26	54.6	2.22	
Lumberton.	96	27	57.9	4.23	0.5
Marion.	95	27	57.8	1.77	
Moncure.	94	26	56.2	1.76	
Monroe.	91	24	57.2	2.36	0.8
Morganton.	92	26	55.4	2.79	2.5
Mountairy.	90	25	52.2	2.30	
Mount Holly.				4.10	
Murphy.				4.34	1.2
Nashville.	95	24	55.5	2.07	T.
Newbern.	92	28	57.4	2.63	0.8
Patterson.	86	27	52.4	2.72	0.5
Pinehurst.	94	28	60.1		
Pink Beds.	82	20	50.6	2.70	
Randleman.				2.40	1.5
Reidsville.	93	26	54.8	3.25	
Rockingham.	95	31	61.2	3.28	0.5
Salem.	91	27	54.4	2.93	
Salisbury.	92	26	55.3	3.99	T.
Sapphire.	83	25	54.6	3.71	1.0
Scotland Neck.	94	27	56.5	3.00	
Selma.	94	29	55.6	1.95	1.0
Settle.	91	26	54.6	1.63	
Sloan.	94	25	58.4	2.07	1.8
Snowhill.	99	23	57.8	2.30	T.
Southern Pines.	100	30	59.5	0.67	
Southport.	89	33	69.2	2.75	
Statesville.	98	20	57.6	2.85	0.5
Tarboro.	96	25	56.0	2.62	3.0
Vade Mecum.	91	24	52.2	3.20	3.3
Washington.	95	24	58.3	1.90	T.
Wash Woods.	90	29	53.3	3.76	T.
Waynesville.	89	26	55.1	4.01	0.5
Weldon.	96	25	54.0		
North Dakota.					
Amenia.	61	-8	22.6	0.03	
Aplin.	68	-8	26.1	0.50	5.0
Ashley.	75	-11	26.8	0.50	5.0
Beach.	74	2	31.4	0.45	3.2
Berlin.	73	-10	26.2	1.02	2.7
Bottineau.	50	-5	19.9	1.12	
Buford.	56	-15	23.8	1.35	13.5
Cando.	47	-15	17.0	0.88	13.0
Chilcot.				1.15	11.5
Coalharbo.	60	-9	24.2	0.85	8.5
Cooperstown.	82	-13	30.2	0.02	0.1
Dickinson.	69	-8	28.6	0.39	3.1
Donnybrook.	49	-16	19.8	0.40	4.0
Dunsmuir.	48	-18	17.6	1.15	11.5
Edgeley.	72	-8	26.9	0.21	1.2
Ellendale.	75	-2	30.2	0.22	
Forman.	62	-8	23.1	0.00	
Fort Berthold.	83	-17	27.0	0.17	2.0
Fort Yates.	81	-10	33.2	0.51	1.9
Fullerton.	72	-8	27.5	0.81	5.8
Gladys.	44	-17	18.4	3.25	21.0
Glenullin.	71	-5	28.2	0.23	1.7
Grafton.				0.20	2.0
Granville.	49	-10	26.6	0.46	4.0
Hamilton.	41	-10	17.2	2.50	14.0
Hillsboro.	52	-6	25.2	0.50	3.3
Hurd.	75	-6	35.3	0.51	3.0
Jamestown.	80	-12	26.5	1.82	3.2
Kulm.	75	-6	25.0	0.69	4.2
Lakota.	43	-16	16.0	0.61	8.0
North Dakota—Cont'd.					
Langdon.	51	-20	19.7	0.75	4.2
Libon.	70	-9	26.5	0.84	5.5
McKinney.	48	-19	18.8	0.87	8.7
Manfred.	56	-15	20.8	0.78	8.3
Mayville.	52	-11	21.6	0.42	4.0
Medora.				0.30	3.0
Melville.	68	-12	23.0	0.80	8.0
Minot.	54	-10	22.9	0.62	5.8
Minto.	53	-10	19.0	0.42	
Moyersville.	59	-13	21.8		
Napoleon.	73	-17	22.2	0.30	2.0
New Salem.	75	-9	27.4	0.35	2.3
Oakdale.	66	0	28.0	0.85	8.5
Oriska.	63	-5	25.0	0.35	1.0
Palermo.	46	-16	18.5	0.78	7.8
Park River.	45	-9	19.6	0.37	3.7
Pembina.	47	-20	16.4	1.42	13.2
Portal.	42	-16	16.1	1.50	10.0
Power.	70	-11	25.4	0.14	1.0
Pratt.	40	-17	17.5	0.88	8.0
Steele.	67	-9	24.3	T.	T.
University.	48	-12	20.0	0.20	2.0
Valley City.	67	-9	23.7	0.47	1.7
Wahpeton.	65	-8	27.6	0.00	
Walhalla.	47	-8	20.2	0.18	1.8
Washburn.	68	0	31.4	0.20	2.0
White Earth.				0.45	4.5
Willow City.	48	-12	17.6	0.60	6.0
Wishek.				T.	T.
Ohio.					
Akron.	80	14	41.3	4.06	4.5
Amesville.	86	20	50.6	6.28	0.2
Bangorville.	80	11	45.0	5.06	3.0
Bellefontaine.	80	16	45.0	4.44	1.5
Benton Ridge.	82	10	45.0	4.69	5.5
Bladensburg.	80	12	45.8	6.54	7.0
Bowling Green.	81	16	43.2	4.60	1.0
Bucyrus.	80	12	43.8	6.01	7.0
Cadiz.	82	15	46.3	6.68	6.2
Cambridge.	85	13	47.5	6.90	2.0
Camp Dennison.	86	22	51.4	9.17	3.3
Canal Dover.	79	12	43.4	6.14	3.0
Canton.	78	14	43.8	5.63	2.5
Circleville.	84	21	47.9	6.84	
Clarington.	87	17	49.6	8.76	1.0
Clarksville.	82	22	49.8	6.19	3.1
Cleveland.	79	15	41.6	3.29	3.6
Dayton.	84	21	49.4	6.00	0.4
Deane.	83	12	44.7	3.76	2.6
Delaware.	82	16	46.1	5.31	3.4
Demos.	81	15	46.8	7.28	2.2
Findlay.	84	10	43.2	3.94	5.0
Frankfort.	83	22	50.4	6.34	0.5
Fremont.	80	13	44.4	4.91	3.0
Garrettsville.	80	-1	41.3	5.92	4.5
Granville.	81	17	46.8	7.49	3.5
Gratiot.	80	16	46.2	6.02	3.0
Green.	93	24	53.4	7.83	
Greenhill.	79	10	42.5	5.19	3.0
Greenville.	84	19	47.4	5.26	4.0
Hedges.	82	9	44.4	4.91	2.0
Hillhouse.	77	7	40.2	2.82	5.0
Hiram.	79	8	41.0	5.65	7.0
Hudson.	82	5	41.0	5.70	7.5
Ironton.	88	23	54.1	4.65	T.
Jacksonburg.	83	20	47.8	7.32	5.0
Jeffersonville.	82	21	48.7	5.14	
Kenton.	80	11	41.1	4.46	4.0
Killbuck.	80	13	45.5	6.59	3.5
Lancaster.	81	21	48.4	7.81	T.
Lima.	81	18	46.2	3.58	8.0
McConnellsville.	83	18	48.4	7.98	0.5
Marietta.	83	23	51.1	6.05	T.
Marion.	83	14	46.0	4.70	4.2
Medina.	80	10	43.2	4.83	7.0
Millford.	80	14	44.4	6.91	5.5
Milligan.	84	19	48.6	9.01	1.0
Millport.	80	12	43.1	4.78	3.2
Napoleon.				4.37	2.0
Nellie.	79	15	46.0	7.26	3.0
New Alexandria.	82	15	46.2	6.35	5.0
New Berlin.	80	9	42.2	5.10	1.0
New Bremen.	83	11	46.2	4.34	4.5
New Richmond.	84	21	51.6	8.74	5.4
New Waterford.	81	10	41.8	6.90	5.0
North Lewisburg.	81	16	46.5	6.10	3.5
North Royalton.	79	8	41.7	6.30	2.1
Norwalk.	82	10	40.8	4.40	6.0
Oberlin.	81	10	42.2	3.65	6.6
Ohio State University.	81	19	47.6	5.80	2.8
Orangeville.	81	6	39.9	2.88	6.0
Ottawa.	84	11	44.6	5.08	T.
Pataaskala.	81	19	46.8	6.94	2.9
Philos.	84	18	48.4	8.53	1.1
Plattsburg.	81	19	47.5	6.32	2.5
Pomeroy.	86	23	49.6		
Portsmouth.	96	25	53.5	4.87	2.0
Pulse.	83	24	50.1	6.99	5.0
Ohio—Cont'd.					
Rittman.	81	9	43.2	4.23	2.5
Rockyridge.	79	15	43.2	4.49	T.
Rome.	84	-2	39.8	3.40	11.0
Shenandoah.	79	11	42.7	4.23	3.5
Sidney.	84	14	47.4		

TABLE II.—Climatological record of cooperative observers—Continued.

Stations.	Temperature. (Fahrenheit.)			Precipitation.	
	Maximum.	Minimum.	Mean.	Rain and melted snow.	Total depth of snow.
Oregon—Cont'd.					
Granite	60	3	33.2	1.55	
Grants Pass	75	22	45.0	7.37	
Heiser	72	20	43.0	1.95	T.
Heppner	64	25	40.8	1.80	
Hermiston				1.40	
Hood River	60	26	42.6	3.32	0.5
Huntington	64	26	44.1	2.88	T.
Jacksonville	70	23	42.9	6.13	2.0
Joseph	62	15	34.8	2.80	20.5
Klamath	64	9	35.2	3.30	5.0
Lagrange	60	20	39.5	2.07	7.0
Lakeview	60	10	33.4	3.79	17.5
McKenzie Bridge	71	21	41.8	6.78	
McMinnville	66	26	44.8	3.11	T.
Marshfield	66	32	46.4	8.54	
Mitchell	66	20	41.2	1.41	2.5
Monroe	68	27	44.0	5.48	
Mountain Park	59	24	38.3	3.28	7.0
Mount Angel	68	29	45.6	4.94	
Nehalem				9.18	T.
Newport	66	32	47.2	6.61	
Odele				3.16	4.2
Olex (near)	69	29	41.4	1.54	0.2
Ontario				0.95	
Orasco	55	20	32.4	11.35	93.5
Paisley	62	21	37.4	2.65	12.0
Pendleton	67	26	42.7	1.70	0.5
Port Orford	63	34	45.7	9.61	
Prineville	65	19	38.9	1.06	T.
Richland	68	27	43.0	0.65	0.5
Riverside	70	19	40.9	1.40	1.0
Salem	66	31	45.7	2.88	
Silver Lake	58	8	36.0	3.23	8.0
Sparta	50	21	36.0	2.33	5.0
Stafford	67	30	43.8	4.69	
Sumpter	42	6	24.0	6.90	69.0
The Dalles	66	27	44.4	1.90	2.0
Toledo	58	28	43.1	9.76	T.
Umatilla	72	30	46.8	2.14	
Vale	72	23	42.9	1.74	T.
Van				2.64	8.0
Wallawa	67	18	38.1	1.21	4.2
Warm Spring	72	22	42.0	1.59	
Weston	65	25	40.4	2.89	2.5
Williams	72	20	44.1	6.93	T.
Pennsylvania.					
Aleppo	82	17	47.6	8.17	1.0
Altoona	83	10	40.4	5.65	
Baldwin	80	11	40.8	3.89	9.0
Beaver Dam				6.99	
Bellefonte	85	11	42.7	4.86	10.0
Brownsville				3.50	
California	84	21	47.8	7.14	2.2
Cassandra	80	9	41.4	7.05	15.0
Clarion				4.18	7.4
Claysville	84	15	47.1	7.66	4.8
Clearfield				6.54	10.1
Coatsville	86	15	43.0	3.81	18.1
Confluence				7.64	1.3
Carapopolis				5.89	7.1
Davis Island Dam				5.56	4.7
Derry	83	15	46.6	7.11	11.5
Doylestown				3.44	
Drifton	83	1	39.4	4.35	14.8
East Mauch Chunk	85	3	39.2	3.24	9.5
Easton	79	12	41.0	2.83	9.0
Ellwood Junction				6.18	3.6
Emporium	80	0	39.2	3.62	10.5
Ephrata	85	10	41.2	2.99	10.0
Everett	92	12	42.5	4.18	8.0
Forks of Nesaminy				2.95	
Franklin	81	8	41.7	4.07	5.0
Freeport	81	14	44.1	6.68	1.3
George School	86	9	41.7	2.98	11.0
Gettysburg	89	13	44.4	3.44	8.2
Girardville				3.31	21.7
Gordon	83	—1	40.0	5.20	17.0
Greensboro				6.60	2.5
Greenville	81	7	41.3	4.27	9.5
Grove City	80	14	42.8	6.22	7.1
Hamburg	84	10	41.0	4.31	7.0
Hanover	90	16	46.3	2.86	8.0
Harris Island Dam				5.63	5.0
Huntingdon	85	10	43.0	5.67	8.0
Hyndman	89	14	44.8	6.21	12.5
Indiana	81	13	43.8	7.71	7.5
Irwin	86	17	46.6	5.81	5.9
Johnstown	86	14	44.4	7.25	10.5
Kennett	82	9	42.1	1.42	11.0
Lansdale				2.09	
Lawrenceville	81	—5	38.6	1.45	11.0
Lebanon	87	14	42.8	3.98	14.5
Leroy	83	2	37.2	1.51	11.0
Lewisburg	85	9	41.4	3.88	11.0
Lockhaven	84	6	42.2	3.76	10.5
Lock No. 4				8.20	
Lycippus	81	16	45.6	7.03	8.2
Marion	86	12	43.2	2.95	13.0
Pennsylvania—Cont'd.					
Mauch Chunk				3.24	9.5
Mifflintown	85	10	42.2	4.63	11.0
Milford	81	—2	37.5	3.07	14.3
Montrose	82	—2	36.0	1.78	12.0
New Germantown	86	9	43.8	3.70	7.0
Ottsville				3.65	
Parker				5.76	9.0
Philadelphia	86	17	45.1	2.82	9.0
Pocono Lake	76	—10	34.0	1.08	6.0
Point Pleasant				3.05	
Pottsville				3.93	
Radford				3.38	8.0
Reading	86	13	43.0	3.89	9.3
Renovo	79	—2	39.6	1.79	9.0
Saegertown	77	0	38.5	3.80	9.5
St. Marys				5.50	6.8
Salisbury				3.16	
Seisholtzville				3.89	8.0
Selinsgrove	84	7	42.2	2.42	
Shawmont				2.58	2.0
Skidmore	80	10	41.6	3.63	
Smiths Corners				7.28	8.3
Somerset	85	12	41.9	1.46	9.0
South Eaton	83	1	39.2	6.20	4.3
Springdale				3.36	
Springmount	86	10	40.6	4.27	10.0
State College	81	—4	38.4	1.35	8.6
Towanda	84	21	47.4	7.89	8.0
Uniontown	81	0	39.6	2.97	7.0
Warren	76	—5	34.7	1.72	12.1
Wellsville	85	13	42.4	3.31	13.5
Westchester				6.65	8.0
West Newton				2.44	
Whitehaven	80	4	36.1	3.19	16.0
Wilkesbarre	82	7	40.1	2.22	8.2
Williamsport	83	9	41.2	1.99	8.0
Rhode Island.					
Bristol	67	17	40.1	1.99	12.0
Kingston	76	12	36.2	3.19	7.2
Pawtucket	78	14	41.1	2.20	6.8
Providence	73	16	40.0	1.90	
South Carolina.					
Aiken	93	40	64.5	0.93	
Allendale	93	41	64.2	0.65	
Anderson	93	35	60.8	1.96	
Batesburg	92	34	64.0	0.96	
Beaufort	93	42	66.0	1.37	
Bennettsville	97	35	62.6	1.81	
Blackville	99	38	65.8	0.59	
Blairs				1.52	
Rowman	96	33	64.8	1.69	
Calhoun Falls				2.69	
Camden	94	35	61.5	1.46	
Catawba				1.10	
Chappells				1.26	
Cheraw	93	31	58.8	1.78	
Clarks Hill	91	35	62.5	1.06	
Clemson College	87	38	59.4	3.11	
Conway	96	30	62.1	1.37	
Darlington	99	29	61.2	2.58	
Dillon	97	29	61.0	2.23	
Due West	90	38	61.4	1.78	
Edisto				2.18	
Effingham				0.75	
Florence	98	31	59.8	1.13	
Georgetown	92	42	64.4	1.21	
Greenville	91	20	55.0	2.14	
Greenwood	89	37	59.5	1.94	
Heath Springs	91	32	61.7	1.60	
Kingstree	95	41	68.2	1.05	
Liberty	91	35	60.4	2.78	
Little Mountain	92	31	62.0	2.23	
Newberry	92	32	60.5	2.32	
Pelzer				2.04	
Pinopolis	89	40	64.6	2.00	
St. George	93	39	65.5	0.90	
St. Matthews	92	35	62.2	0.84	
St. Stephens				0.95	
Saluda	92	32	62.2	1.70	
Santuck	92	31	59.6	2.45	
Smiths Mills				0.90	
Society Hill	90	31	60.2	2.54	
Spartanburg	95	32	58.6	1.21	
Stateburg	95	40	64.3	1.79	
Summerville	98	34	66.2	0.93	
Trenton	90	38	60.6	1.64	
Trial	95	31	64.0	0.98	
Walhalla	94	36	61.5	2.83	
Walterboro	98	36	67.6	1.24	
Winnsboro	92	35	61.2	1.95	
Winthrop College	86	25	58.2	2.18	
Yemassee	92	36	64.6	0.80	
Yorkville	94	37	60.5	1.99	
South Dakota.					
Aberdeen	79	—9	31.5	1.17	11.7
Academy	88	—2	42.2	0.35	T.
Alexandria	86	—6	37.2	T.	T.
Armour	84	25	46.3	0.10	1.0
South Dakota—Cont'd.					
Ashcroft	79	—3	36.2	0.10	1.0
Bowdle	77	—8	30.4	0.60	6.0
Brookings	75	—8	34.1	0.55	3.7
Canton	76	—8	36.4	0.57	3.8
Castlewood	72	—10	31.2	1.16	9.7
Centerville	78	—5	37.2	0.71	4.0
Chamberlain	86	—2	41.2	0.97	0.2
Cherry Creek	85	—4	41.2	0.19	
Clark	76	—9	30.0	0.87	8.7
Clear Lake	70	—1	31.2	1.30	11.0
Desmet	78	—2	34.0	0.19	1.9
Elkpoint	84	—1	40.6	0.25	
Fairfax	88	—14	45.1	0.12	1.0</

TABLE II.—Climatological record of cooperative observers—Continued.

Stations.	Temperature. (Fahrenheit.)			Precipitation.	
	Maximum.	Minimum.	Mean.	Rain and melted snow.	Total depth of snow.
Tennessee—Cont'd.					
Sevierville	88	27	57.2	5.43	
Sewanee	84	31	59.6	4.50	
Silver Lake	98	22	50.4	3.49	
Sparta	87	28	58.2	5.83	
Springdale	88	32	56.3	4.29	T.
Springville	88	27	59.8	3.54	
Tazewell			5.07		0.5
Tellico Plains	89	28	59.5	4.27	T.
Tracy City	83	28	56.3	5.15	
Trenton	85	28	60.0	3.60	
Tullahoma	86	29	60.2	5.30	
Union City	87	32	60.0	3.10	
Walling			7.84		
Watertown			3.20		
Waynesboro	87	30	60.6	7.16	
Wildersville	84	33	60.3	4.86	
Yukon	87	32	60.6	4.58	
Texas.					
Albany	97	28	64.6	1.30	
Alvin			3.76		
Arthur			3.04		
Austin	82	37	68.4	1.68	
Ballinger	96	30	67.3	0.06	
Barstow	94	33	64.0	0.85	
Beaumont			2.24		
Beville	92	44	72.2	0.97	
Big Springs			1.69		
Blanco			1.48		
Boerne			1.40		
Bonham	95	31	66.7	1.71	
Bosch			2.78		
Bowie	98	34	66.3	1.78	
Brenham	87	42	71.3	2.60	
Brighton	82	50	71.0	1.26	
Canadian			T.		
Channing	96	15	58.7	0.00	
Childress	100	21	61.9	T.	
Clarksville	89	36	64.5	1.53	
Claude			0.10		
Coleman			1.04		
College			2.96		
Colorado	95	27	65.4	2.04	
Columbus			2.21		
Corsicana			1.79		
Crockett	88	36	69.8	2.48	
Cuero			1.60		
Dallas	94	37	66.7	1.32	
Dalhart	97	15	58.8	T.	
Danewang			2.25		
Denison			4.40		
Dialville	85	41	68.0	2.15	
Duval	89	40	70.6	2.03	
Eagle Pass	97	45	74.5	0.02	
Falfurrias			0.55		
Fort Clark	92	41	70.2	0.00	
Fort McIntosh	98	40	75.6	0.30	
Fredericksburg	88	34	68.3	0.63	
Gatesville	91	35	68.2	0.95	
Georgetown	93	34	71.4	1.19	
Gonzales			2.15		
Graham	100	29	65.2	1.18	
Grapevine	96	36	68.8	0.68	
Greenville	90	38	67.3	2.04	
Hallettsville			2.80		
Haskell	99	30	65.2	2.10	
Hebronville			0.30		
Hempstead			2.75		
Hereford	98	17	57.1	0.00	
Hewitt			0.96		
Honda	91	41	70.4	1.81	
Houston	90	47	72.1	3.74	
Hubbard	89	38	67.8	0.91	
Huntville	87	39	69.8	2.46	
Jewett	88	32	68.4	2.00	
Keene	93	38	67.6	1.18	
Kent	93	29	59.4	T.	
Kerrville	89	31	70.2	0.51	
Klickerbocker	96	27	66.6	0.84	
Kopperl			1.20		
Lampasas			0.67		
Lapara			2.10		
Laureles Ranch			0.82		
Liberty	89	40	70.6	2.70	
Llano	93	30	69.0	0.03	
Lone Star Ranch			0.00		
Longlake			2.67		
Longview	87	37	66.4	4.10	
Lufkin	89	38	70.4	2.03	
Luling	88	41	70.4	1.62	
McLean	98	20	58.0	0.02	
Mexia	90	37	67.0	2.73	
Miami	99	20	58.8	T.	
Mount Blanco	96	22	59.0	0.22	
Nacogdoches	87	35	68.1	2.15	
Nazareth	94	16	56.5	0.10	
New Braunfels	89	41	71.5	2.24	
Orange			1.00		
Panther			1.65		
Texas—Cont'd.					
Paris	89	38	65.6	2.50	
Pierce	86	42	70.1	2.75	
Plemons	98	15	55.2	0.00	
Port Lavaca	85	49	71.8	1.41	
Rhineland	100	28	63.0	3.50	
Riverside			2.02		
Rockland	87	42	70.4	1.82	
Rockport			3.75		
Sabinal			2.00		
Sabinal	94	39	71.6	0.50	
San Marcos	89	39	69.4	1.44	
San Saba	92	32	68.4	2.10	
Santa Gertrude			0.62		
Seymour	96	30	63.8	3.55	T.
Sherman			1.35		
Sonora	91	29	66.3	0.62	
Sulphur Springs	87	36	65.9	2.31	T.
Temple	91	36	67.8	0.98	
Tilden	99	36	75.0	0.77	
Trinity	90	34	72.0	2.27	
Valley Junction			0.79		
Victoria	88	45	72.4	1.52	
Waco	90	37	68.4	0.82	
Waxahachie	95	33	66.8	1.52	
Weatherford	94	34	66.3	0.83	
Wichita Falls	93	31	63.4	1.99	
Willis	91	40	71.0	2.70	
Willispoint	86	33	65.6	2.30	
Utah.					
Alpine			3.50		
Aneth	83	19	51.4	0.72	2.0
Beaver	67	21	46.8	0.60	
Blackrock	73	14	44.2	1.50	8.0
Castledale	74	13	43.8	T.	
Castlerock			2.14		17.5
Cedar City	70	13	41.8	1.58	7.5
Corinne	60	23	41.3	2.12	5.0
Deseret	78	15	46.0	1.00	11.0
Emery	69	21	43.6	0.34	
Enterprise			3.00		5.0
Escalante	75	15	41.8	1.06	
Experiment Farm	86	23	51.3		
Farmington	65	23	43.2	3.25	20.0
Fillmore	75	20	45.2	1.34	
Fort Duchesne	75	15	42.2	0.00	
Frisco	66	18	39.0	0.60	
Garrison	71	10	42.7	0.90	
Government Creek	63	6	40.9	2.22	19.0
Grayson	78	18	44.4	1.23	1.0
Heber	64	3	38.0	3.29	27.0
Henefer	69	11	40.4	2.76	14.0
Hite	86	29	54.2	0.51	T.
Huntsville			4.08		14.0
Ibapah	54	5	31.7	3.52	32.8
Karnah	75	9	40.3	1.30	
Kelton			0.23		2.0
La Sal	70	10	40.2		
Levan	67	13	41.8	1.21	8.9
Lea	64	8	35.0	0.00	
Logan	64	19	38.3	3.54	
Manti	69	14	42.0	0.42	
Marion			3.62		30.0
Marysville	71	8	42.0	0.61	2.3
Meadowville	53	14	33.6	3.80	20.5
Millville			3.15		
Minersville			1.76		7.0
Moab	84	24	52.6	0.92	2.5
Morgan	68	15	41.2	2.48	12.0
Mount Nebo	69	15	44.6	1.12	10.0
Mount Pleasant	72	13	41.4	1.41	11.0
Nephi			2.26		25.2
Oak City	71	14	44.8	1.47	
Ogden	65	24	43.5	3.50	6.8
Parowan	75	9	41.4	1.61	11.3
Payson			2.74		18.0
Pinto	64	2	38.2	2.92	
Plateau	67	2	37.8	1.12	10.7
Provo	68	13	43.4	2.80	24.0
Ranch	63	1	35.6	3.87	
Randolph			1.04		
Richfield	81	17	46.0	0.06	
Rockfield	81	34	56.8	1.33	
St. George	85	26	52.5	0.88	
Salt Air	71	23	44.6	1.88	
Scipio	70	12	41.8	1.41	T.
Snowville	64	1	38.2	2.55	
Soldier Summit	56	10	34.1	1.55	14.0
Sunnyside			0.26		1.0
Theodore	70	17	41.0	0.25	1.0
Thistle	70	6	43.5	0.80	8.0
Tooele	68	16	42.6	2.68	
Tropic	72	18	40.4	0.39	0.2
Trout Creek	73	17	43.0	1.05	10.5
Vernal	79	18	43.6	0.76	
Woodruff	60	12	34.0	1.00	7.5
Wellington	87	14	44.7	0.05	
Vermont.					
Bloomfield	52	-23	24.8	2.27	15.7
Vermont—Cont'd.					
Cavendish	64	-3	31.2	1.45	8.0
Chelsea	55	-5	27.3	1.77	17.0
Enosburg Falls	65	-21	29.2	1.91	5.0
Jacksonville	59	-11	29.3	1.28	9.0
Manchester	73	-2	32.2	0.62	T.
Norwich	58	-13	28.6	2.33	12.0
St. Johnsbury	56	-19	28.0	2.62	19.2
Wells	60	-2	30.1	2.02	2.0
Woodstock	56	-16	27.0	2.00	10.0
Virginia.					
Arvonia	96	18	52.5	2.86	2.2
Ashland	92	22	51.2	3.15	4.5
Bigstone Gap	85	26	54.0	5.21	T.
Blacksburg	85	19	47.0	3.96	8.0
Buchanan			1.93		T.
Burkes Garden	76	15	46.9	4.72	14.0
Callaville	92	23	53.4	4.78	1.0
Charlottesville	94	23	52.3	1.96	1.5
Clarksburg			3.42		2.1
Columbia	83	21	52.0	2.92	2.5
Dale Enterprise	91	17	48.8	2.61	4.0
Danville			2.52		0.5

TABLE II.—Climatological record of cooperative observers—Continued. Late reports for February, 1907.

Temperature. (Fahrenheit.)						Precipitation.	
Stations.			Maximum.	Minimum.	Mean.	Rain and melted snow.	Total depth of snow.
Washington—Cont'd.							
Rex Creek	59	28	41.2	0.65	Ins.		
Ritzville	60	24	38.4	2.15	T. 1.7		
Rosalie	54	11	30.2	2.32	20.2		
Ruby Hill	59	26	41.6	3.18			
Sedro	65	29	42.8	1.51			
Sixprong	60	20	41.2	2.74			
Snodish	59	26	40.8	2.88			
Snodish	52	20	36.9	1.56	T.		
Stehkin	52	10	33.0	0.40	T.		
Stokes	72	25	44.6	1.97			
Touchet	53	8	34.4	0.60	5.5		
Twisp	68	24	42.2	7.99	2.0		
Union	68	28	44.4	2.67			
Vancouver	56	29	42.3	1.94			
Vashon	67	26	43.0	2.19			
Wahluke	60	13	32.5	1.10	11.0		
Waterville	60	22	37.3	0.37	2.3		
Wenatchee (near)	61	14	35.0	0.65	5.0		
Wilbur	63	27	42.2	7.74	0.7		
Yale	62	30	44.8	2.72			
Zindel							
West Virginia.							
Bancroft	87	23	50.8	4.67	2.0		
Bayard	80	2	43.2	6.45	21.0		
Beckley	83	18	49.1	3.32	7.0		
Bens Run	83	22	49.6	6.81	3.0		
Berkley Springs	92	11	46.9	4.80	7.6		
Burlington	88	17	46.3	2.70	10.0		
Cairo	90	20	51.5	6.57			
Central	86	16	49.3	3.09	1.0		
Charleston	87	25	55.1	4.90	1.5		
Creston	85	22	50.0	4.56	T.		
Cuba	86	20	51.7	5.36	1.5		
Davis	83	19	52.6	5.80			
Elkhorn	83	19	52.6	4.63	4.5		
Fairmont	85	20	50.0	6.10	T.		
Franklin	88	18	48.0	3.10	2.0		
Glenville	86	23	51.8	4.45	T.		
Grafton	84	19	49.8	5.43	5.0		
Green Sulphur Springs	87	22	50.8	3.98			
Harpers Ferry	87	22	50.8	2.26			
Hinton	85	25	52.4	4.25	3.0		
Huntington	87	23	51.8	4.98	3.0		
Leonard	79	16	46.2				
Lewisburg	84	19	47.3	4.72	6.0		
Logan	91	26	57.1	5.12	2.0		
Lost City	84	21	48.2	3.05	4.0		
Lost Creek	85	16	50.4	4.10	1.0		
Madison	89	21	52.0				
Mannington	87	20	49.8	5.89	3.1		
Martinsburg	90	14	44.7	3.90	9.0		
Moorefield	93	15	49.6	1.05	4.0		
Mooresville	84	19	48.4	7.18	T.		
Morgantown	85	21	50.6	6.97	5.0		
Moundsville	83	15	44.4	8.18	0.2		
New Cumberland	83	15	44.4	3.95	2.0		
Nuttallburg	78	20	45.8	1.99	1.0		
Oceana	88	23	54.5	5.00	0.4		
Parsons	83	12	46.3	6.20	6.5		
Phillippi	84	15	48.9	5.61	4.6		
Pickens	80	15	45.9	7.10	12.0		
Point Pleasant	86	24	53.9	5.41	T.		
Powellton	89	24	54.3	1.90	T.		
Princeton	79	14	46.6	6.80	14.0		
Romney	94	19	47.8	2.53	4.5		
Rowlesburg	71	8	40.0	7.17	8.0		
Ryan	86	20	51.2	5.13	4.0		
Smithfield	86	21	51.8	5.93			
Southside	86	21	51.8	5.14	2.8		
Spencer	87	19	48.6	4.14	3.0		
Sutton	92	24	53.7	4.60	5.0		
Terra Alta	81	15	44.2	7.36	12.6		
Union	81	19	48.8	3.71	5.5		
Uppertract	90	16	48.0	2.52	1.0		
Wellsburg	78	17	44.8	6.72	5.4		
Weston	94	18	49.4	5.33	3.8		
Wheeling	90	20	53.6	4.24	1.0		
Williamson	89	25	55.6	4.16	2.0		
Wisconsin.							
Amherst	66	4	35.4	0.79	3.7		
Antigo	60	-4	31.5	0.75	7.5		
Appleton	64	9	36.2	1.98	6.9		
Appleton Marsh	70	6	33.6	1.95	2.1		
Ashland	50	-10	27.5	1.65	8.0		
Barron	56	-10	27.1	1.08	4.2		
Beloit	80	15	40.0	1.59	0.8		
Black River Falls				1.86			
Broadhead	80	15	40.8	2.13	2.5		
Burnett	65	12	36.8	1.71	2.5		
Butternut	54	-13	27.0	1.52	11.4		
Chilton	64	9	35.0	2.54	6.5		
Chippewa Falls				2.60	6.0		
Downing	64	-14	29.8	2.21	20.0		
Eau Claire	70	3	32.2	1.95	3.0		
Florence	56	-13	26.9	1.50	5.5		
Fond du Lac	65	10	37.7	2.04	1.8		
Grand Rapids	69	7	34.4	1.97	3.0		
Wyoming.							
Afton	55	1	31.8	1.90	15.0		
Barnum				0.35	5.2		
Barrett Creek	52	-8	28.0	1.96	17.5		
Basin	75	4	40.9	0.14	4.0		
Bedford	82	6	31.2	3.22	16.9		
Blue Cap	51	2	26.5	3.80	38.0		
Buffalo	72	7	37.2	0.07	0.7		
Chugwater	79	4	41.2	0.45	5.0		
Clark	67	12	38.9	1.34	13.0		
Clear Creek Cabin	52	-5	25.6	1.01	8.5		
Daniel	48	-16	21.7	1.87	18.7		
Dubois				1.33	12.3		
Elk Mountain				1.41	26.5		
Evanston	60	-2	33.2	1.95	8.5		
Fort Laramie	80	-2	41.4	0.41	5.8		
Granite Canyon	68	7	37.2	1.20	13.0		
Granite Springs	68	7	39.3	0.75	9.5		
Green River	63	13	36.2	0.49	5.5		
Griggs	71	9	39.3	0.53	3.8		
Hatton				1.03	10.5		
Hyattville	71	11	39.6				
Jackson				4.43	27.0		
Kirtley	72	5	37.6	0.31	5.0		
Laramie	67	2	36.1	0.28	2.8		
Leo	61	-6	35.3	0.71	9.0		
Little Medicine	54	-4	30.6	2.07	24.0		
Lusk	73	0	39.2	0.90	9.0		
Moorecroft	74	-2	39.2	0.50	5.0		
Moore	73	7	40.2	0.32	2.4		
New Castle	72	15	39.5	0.90	4.0		
Pathfinder	66	4	38.8	0.55	4.5		
Phillips	79	5	42.4	0.20	2.0		
Pine Bluff	86	9	43.7	0.80	8.0		
Pinedale	55	-11	24.5	1.50	12.0		
Rawlins	63	5	34.2	0.20	1.5		
Riverton	69	13	39.8	0.18	0.6		
Saratoga	69	11	36.6	0.87	5.7		
Sheridan	75	4	39.1	0.45	2.0		
Shoshone Canyon	64	10	37.0	0.99	8.5		
South Pass City	42	-13	19.6	5.00	51.0		
Wells	39	-14	20.5	2.95	22.0		
Wheatland	84	10	46.0	2.90	14.0		
Wolf	72	5	39.2	1.35	14.0		
Yellowstone Pk. (G. Can.)	41	-13	17.6	3.22	44.7		
Yellowstone Pk. (Lake)	46	-10	23.7	7.48	65.0		
Yellowstone Pk. (Norris)	56	-9	26.4				
Yellowstone Pk. (Riv'side)	49	-5	27.0	4.05	36.0		
Yellowstone Pk. (Soda B.)	52	-5	30.2	1.74	12.0		
Yellowstone Pk. (T. Sta.)	48	-7	25.1	3.33	53.0		
Yellowstone Pk. (Up. Ba.)	47	-10	25.4	5.70			
Porto Rico.							
Adjuntas	80	55	68.0	2.70			
Aguirre	94	82	72.4	0.05			
Albonita	89	48	68.0	3.31			
Porto Rico—Cont'd.							
Anasco	87	59	74.0	0.45	Ins.		
Arecibo	84	53	69.8	2.11			
Barros	82	50	67.2	4.58			
Bayamon	86	56	71.2	1.81			
Caguas	89	52	70.5	2.58			
Canovanas	84	66	75.2	2.73			
Cayey	88	46	67.2	1.25			
Cidra	86	50	69.7	2.81			
Carozal	84	55	70.4	3.42			
Fajardo	85	60	75.0	2.66			
Guanica	91	60	75.4	0.00			
Guayama				0.11			
Hacienda Colosa	68	55	71.6	0.57			
Humacao	85	59	72.2	0.14			
Isabel	87	62	75.0	1.83			
Igolina	82	55	68.2	3.29			
Juana Diaz	89	61	76.2	0.00			
La Carmelita	85	56	69.4	2.37			
Lares	84	54	70.0	2.94			
Las Cruces	79	57	69.7	2.35			
Las Marias	84	56	70.6	1.32			
Manati	87	58	73.3	3.55			
Maunabo	89	59	77.0	1.35			
Mayaguez	90	56	73.4	0.47			
Ponce	88	59	74.9	0.25			
Rio Blanco	87	56	72.1	4.12			
Rio Piedras				3.11			
San German	86	54	69.9	2.16			
San Lorenzo	86	51	69.6	1.13			
San Salvador	81	55	67.8	2			

TABLE II.—*Climatological record of cooperative observers—Continued. Late reports for February, 1907.*

Stations.	Temperature. (Fahrenheit.)			Precipitation.	
	Maximum.	Minimum.	Mean.	Rain and melted snow.	Total depth of snow.
<i>Vermont.</i>	°	°	°	<i>Inch.</i>	<i>Inch.</i>
Cavendish .....	36	-13	11.9	1.02	14.0
<i>West Virginia.</i>					
Logan .....	68	7	40.2	3.35	10.0
<i>Wyoming.</i>					
Yellowstone Pk. (G. Can.)	41	23	18.0	0.95	17.0

## EXPLANATION OF SIGNS.

\* Extremes of temperature from observed readings of dry thermometer.

A numeral following the name of a station indicates the hours of observation from which the mean temperature was obtained, thus:

<sup>1</sup> Mean of 7 a. m. + 2 p. m. + 9 p. m. + 9 p. m. + 4.

<sup>2</sup> Mean of 8 a. m. + 8 p. m. + 2.

<sup>3</sup> Mean of 7 a. m. + 7 p. m. + 2.

<sup>4</sup> Mean of 6 a. m. + 6 p. m. + 2.

<sup>5</sup> Mean of 7 a. m. + 2 p. m. + 2.

\* Mean of readings at various hours reduced to true daily mean by special tables.

The absence of a numeral indicates that the mean temperature has been obtained from daily readings of the maximum and minimum thermometers.

An italic letter following the name of a station, as "*Livingston a*," "*Livingston b*," indicates that two or more ob-

servers, as the case may be, are reporting from the same station. A small roman letter following the name of a station, or in figure columns, indicates the number of days missing from the record; for instance, "*a*" denotes 14 days missing.

No note is made of breaks in the continuity of temperature records when the same do not exceed two days. All known breaks of whatever duration, in the precipitation record receive appropriate notice.

## CORRECTIONS.

*February, 1907.*

Nebraska, Chester, make precipitation 0.90, and Lynch, make mean temperature 26.7°.

TABLE III.—Wind resultants, from observations at 8 a. m. and 8 p. m., daily, during the month of March, 1907.

Stations.	Component direction from—				Resultant.		Stations.	Component direction from—				Resultant.	
	N.	S.	E.	W.	Direction from—	Duration.		N.	S.	E.	W.	Direction from—	Duration.
New England.													
Eastport, Me.	Hours.	Hours.	Hours.	Hours.	°	Hours.	Moorhead, Minn.	Hours.	Hours.	Hours.	Hours.	°	Hours.
Portland, Me.	23	17	12	27	n. 68 w.	16	Bismarck, N. Dak.	24	17	14	22	n. 49 w.	11
Concord, N. H. †	25	20	7	26	n. 75 w.	20	Devils Lake, N. Dak.	24	13	22	19	n. 15 e.	11
Burlington, Vt. †	20	4	6	9	n. 11 w.	16	Williston, N. Dak.	15	21	15	26	s. 61 w.	12
Northfield, Vt.	6	12	10	11	s. 9 w.	6	Upper Mississippi Valley.						
Boston, Mass.	23	32	5	15	s. 48 w.	14	Minneapolis, Minn. †	22	13	18	23	n. 29 w.	10
Nantucket, Mass.	21	15	12	28	n. 69 w.	17	St. Paul, Minn.	12	10	7	13	n. 72 w.	6
Block Island, R. I.	20	20	14	25	w.	11	La Crosse, Wis. †	22	16	18	20	n. 18 w.	6
Providence, R. I.	19	19	15	28	w.	13	Madison, Wis.	14	10	4	8	n. 45 w.	6
Hartford, Conn.	21	16	13	27	n. 70 w.	15	Charles City, Iowa.	16	20	16	24	s. 63 w.	9
New Haven, Conn.	28	21	5	19	n. 63 w.	16	Davenport, Iowa.	25	15	17	20	n. 17 w.	10
Middle Atlantic States.													
Albany, N. Y.	24	24	9	18	w.	9	Des Moines, Iowa.	18	15	19	21	n. 34 w.	4
Binghamton, N. Y. †	8	6	12	10	n. 45 e.	3	Dubuque, Iowa.	24	18	19	19	n.	6
New York, N. Y.	26	15	12	23	n. 45 w.	16	Keokuk, Iowa.	21	17	14	24	n. 68 w.	11
Harrisburg, Pa.	22	13	19	22	s. 18 w.	10	Calro, Ill.	22	16	17	23	n. 45 w.	8
Philadelphia, Pa.	24	21	13	20	n. 67 w.	8	La Salle, Ill. †	21	26	19	14	n. 45 e.	7
Scranton, Pa.	18	24	16	20	s. 34 w.	7	Peoria, Ill.	9	6	11	13	n. 34 w.	4
Atlantic City, N. J.	24	20	11	22	n. 70 w.	12	Springfield, Ill.	20	22	14	14	s.	2
Cape May, N. J.	25	23	11	15	n. 63 w.	4	Hannibal, Mo. †	16	24	17	16	s. 7 e.	8
Baltimore, Md.	21	16	18	22	n. 39 w.	6	St. Louis, Mo.	12	8	9	10	n. 14 w.	4
Washington, D. C.	23	22	14	17	n. 72 w.	3	Missouri Valley.						
Lynchburg, Va.	15	22	16	27	s. 58 w.	13	Columbia, Mo. †	9	12	10	6	s. 53 e.	5
Mount Weather, Va.	20	18	11	30	n. 84 w.	19	Kansas City, Mo.	15	24	23	11	s. 53 e.	15
Norfolk, Va.	21	21	17	15	e.	2	Springfield, Mo.	16	29	18	12	s. 25 e.	14
Richmond, Va.	24	27	11	10	s. 18 e.	3	Iola, Kans. †	9	12	12	6	s. 63 e.	7
Wytheville, Va.	20	2	12	35	n. 52 w.	29	Topeka, Kans. †	10	12	12	3	s. 77 e.	9
South Atlantic States.													
Asheville, N. C.	30	17	16	14	n. 9 e.	13	Lincoln, Nebr.	25	22	22	9	n. 77 e.	13
Charlotte, N. C.	14	23	23	18	s. 29 e.	10	Omaha, Nebr.	28	21	15	12	n. 23 e.	8
Hatteras, N. C.	23	12	19	23	n. 20 w.	12	Valentine, Nebr.	18	19	13	24	s. 85 w.	11
Raleigh, N. C.	16	19	16	24	s. 69 w.	8	Sioux City, Iowa †	12	8	11	7	n. 45 e.	6
Wilmington, N. C.	18	15	18	23	n. 59 w.	6	Pierre, S. Dak.	16	16	30	16	e.	14
Charleston, S. C.	12	20	18	23	s. 32 w.	9	Huron, S. Dak.	26	16	21	15	n. 31 e.	12
Columbia, S. C.	17	14	20	23	n. 45 w.	4	Yankton, S. Dak. †	11	8	9	10	n. 18 w.	3
Augusta, Ga.	14	17	18	26	s. 69 w.	8	Northern Slope.						
Savannah, Ga.	14	16	16	26	s. 79 w.	10	Havre, Mont.	16	7	27	25	n. 13 e.	9
Jacksonville, Fla.	17	23	21	19	s. 18 e.	6	Miles City, Mont.	22	14	23	16	n. 41 e.	11
Florida Peninsula.													
Jupiter, Fla.	15	24	17	22	s. 29 w.	10	Helena, Mont.	13	19	8	35	s. 78 w.	28
Key West, Fla.	24	11	34	7	n. 64 e.	30	Kalispell, Mont.	7	18	6	39	s. 72 w.	35
Tampa, Fla.	17	9	15	33	n. 66 w.	20	Rapid City, S. Dak.	16	18	13	23	s. 76 w.	8
Eastern Gulf States.													
Atlanta, Ga.	14	19	17	26	s. 61 w.	10	Cheyenne, Wyo.	19	17	5	33	n. 86 w.	28
Macon, Ga. †	10	11	7	13	s. 80 w.	6	Lander, Wyo.	19	21	4	32	s. 86 w.	28
Thomasville, Ga.	16	24	9	22	s. 58 w.	15	Yellowstone Park, Wyo.	8	41	6	24	s. 29 w.	38
Pensacola, Fla. †	10	10	10	10	s.	12	North Platte, Nebr.	19	18	20	18	n. 63 e.	2
Anniston, Ala.	18	30	14	13	s. 5 e.	12	Middle Slope.						
Birmingham, Ala.	16	31	13	16	s. 11 w.	15	Denver, Colo.	18	27	8	22	s. 57 w.	17
Mobile, Ala.	12	35	16	11	s. 12 e.	24	Pueblo, Colo.	23	10	17	27	n. 38 w.	16
Montgomery, Ala.	14	27	10	22	s. 43 w.	18	Concordia, Kans.	15	25	21	13	s. 39 e.	13
Meridian, Miss.	13	32	11	17	s. 18 w.	20	Dodge, Kans.	17	22	23	16	s. 54 e.	9
Vicksburg, Miss.	11	35	15	15	s.	24	Wichita, Kans.	16	29	20	9	s. 40 e.	17
New Orleans, La.	9	37	14	14	s.	28	Oklahoma, Okla.	18	37	8	5	s. 9 e.	19
Western Gulf States.													
Shreveport, La.	12	38	21	5	s. 32 e.	39	Southern Slope.						
Bentonville, Ark. †	6	18	9	3	s. 27 e.	13	Abilene, Tex.	16	36	8	11	s. 9 w.	20
Fort Smith, Ark.	11	26	21	12	s. 31 e.	18	Amarillo, Tex.	9	36	13	15	s. 4 w.	27
Little Rock, Ark.	13	30	14	14	s. 3 e.	17	Del Rio, Tex. †	4	10	23	1	s. 75 e.	23
Corpus Christi, Tex.	8	37	31	2	s. 45 e.	41	Roswell, N. Mex.	20	22	11	23	s. 81 w.	12
Fort Worth, Tex.	12	36	12	12	s.	24	Southern Plateau.						
Galveston, Tex.	7	41	25	2	s. 34 e.	41	El Paso, Tex.	21	9	8	38	n. 68 w.	32
Palestine, Tex.	13	41	7	8	s. 2 w.	28	Santa Fe, N. Mex.	24	16	16	23	n. 41 w.	11
San Antonio, Tex.	11	34	31	3	s. 51 e.	36	Flagstaff, Ariz.	15	21	2	41	s. 81 w.	40
Taylor, Tex. †	8	19	4	2	s. 10 e.	11	Phoenix, Ariz.	17	11	28	19	n. 56 e.	11
Ohio Valley and Tennessee.													
Chattanooga, Tenn.	20	25	16	19	s. 31 w.	6	Yuma, Ariz.	17	10	17	29	n. 60 w.	14
Knoxville, Tenn.	20	25	13	24	s. 66 w.	12	Independence, Cal.	16	31	11	16	s. 18 w.	16
Memphis, Tenn.	13	32	15	14	s. 3 e.	19	Middle Plateau.						
Nashville, Tenn.	16	25	17	20	s. 18 w.	10	Reno, Nev.	9	25	7	30	s. 55 w.	28
Lexington, Ky. †	7	14	10	7	s. 23 e.	8	Tonopah, Nev.	8	33	32	12	s. 39 e.	32
Louisville, Ky.	16	27	14	16	s. 10 w.	11	Winnemucca, Nev.	11	24	8	35	s. 64 w.	30
Evansville, Ind. †	10	13	10	5	s. 39 e.	6	Modena, Utah.	5	22	4	45	s. 68 w.	44
Indianapolis, Ind.	20	24	15	17	s. 27 w.	4	Salt Lake City, Utah.	10	30	25	12	s. 33 e.	24
Cincinnati, Ohio.	18	20	17	24	s. 74 w.	7	Durango, Colo.	18	19	7	32	s. 88 w.	25
Columbus, Ohio.	19	23	14	21	s. 60 w.	8	Grand Junction, Colo.	15	18	21	19	s. 34 e.	4
Pittsburg, Pa.	21	21	10	27	w.	17	Northern Plateau.						
Parkersburg, W. Va.	20	24	11	20	s. 66 w.	10	Baker City, Oreg.	11	37	14	11	s. 7 e.	26
Elkins, W. Va.	18	20	5	26	s. 85 w.	21	Boise, Idaho.	16	27	13	13	s. 52 e.	18
Lower Lake Region.													
Buffalo, N. Y.	13	22	15	27	s. 53 w.	15	Lewiston, Idaho †	5	7	18	6	s. 81 e.	12
Canton, N. Y. †	6	9	9	15	s. 63 w.	7	Pocatello, Idaho.	6	32	22	20	s. 4 e.	26
Oswego, N. Y.	11	31	13	20	s. 19 w.	21	Spokane, Wash.	17	27	15	19	s. 22 w.	11
Rochester, N. Y.	7	21	11	36	s. 61 w.	29	Walla Walla, Wash.	11	42	7	12	s. 9 w.	31
Syracuse, N. Y.	8	26	17	22	s. 16 w.	19	North Pacific Coast Region.						
Erie, Pa.	15	21	14	24	s. 59 w.	12	North Head, Wash.	17	23	20	18	s. 18 e.	6
Cleveland, Ohio.	17	24	15	20	s. 36 w.	9	Port Crescent, Wash. †	8	9	11	12	s. 45 w.	1
Sandusky, Ohio †	10	9	8	13	n. 79 w.	5	Seattle, Wash.	17	28	21	11	s. 42 e.	15
Toledo, Ohio.	20	20	14	23	w.	9	Tacoma, Wash.	17	28	11	27	s. 56 w.	19
Detroit, Mich.	18	12	21	22	n. 9 w.	6	Tatoosh Island, Wash.	8	20	26	17	s. 37 e.	15
Upper Lake Region.													
Alpena, Mich.	23	19	11	22	n. 70 w.	12	Portland, Oreg.	14	27	18	21	s. 13 w.	13
Escanaba, Mich.	25	20	14	17	n. 31 w.	6	Roseburg, Oreg.	13	24	13	24	s. 45 w.	16
Grand Haven, Mich.	22	14	19	20	n. 7 w.	8	Middle Pacific Coast Region.						
Grand Rapids, Mich.	20	16	19	22	n. 37 w.	5	Eureka, Cal.	17	23	19	13	s. 45 e.	8
Houghton, Mich. †	8	3	11	15	n. 39 w.	6	Mount Tamalpais, Cal.	13	26	6	30	s. 62 w.	27
Marquette, Mich.	20	19	14	24	n. 84 w.	10	Red Bluff, Cal.	14	30	21	12	s. 29 e.	18
Port Huron, Mich.	21	20	14	20	n. 80 w.	6	Sacramento, Cal.	10	31	23	12	s. 28 e.	24
Sault Ste. Marie, Mich.	19	9	18	28	n. 45 w.	14	San Francisco, Cal.	16	21	8	28	s. 76 w.	21
Chicago, Ill.	20	17	18	23	n. 59 w.	6	San Jose, Cal. †	7	11	5	15	s. 68 w.	11
Milwaukee, Wis.	20	16	19	21	n. 27 w.	4	Southeast Farallon, Cal. †	12	12	2	13	w.	11
Green Bay, Wis.	18	20	12	25	s. 81 w.	13	South Pacific Coast Region.						
Duluth, Minn.	24	9	16	27	n. 36 w.	19	Fresno, Cal.	21	25	16	16	s.	4
North Dakota.													
Moorhead, Minn.	Hours.	Hours.	Hours.	Hours.	°	Hours.	Los Angeles, Cal.	18	8	19	29	n. 45 w.	14
Bismarck, N. Dak.	24	17	14	22	n. 49 w.	11	San Diego, Cal.	25	8	18	24	n. 19 w.	18
Devils Lake, N. Dak.	24	13	22	19	n. 15 e.	11	San Luis Obispo, Cal.	18	25	7	21	s. 63 w.	16
Williston, N. Dak.	15	21											

TABLE IV.—Accumulated amounts of precipitation for each 5 minutes, for storms in which the rate of fall equaled or exceeded 0.25 in any 5 minutes, or 0.80 in 1 hour, during March, 1907, at all stations furnished with self-registering gages.

Stations.	Date.	Total duration.		Total amount of precipita- tion.	Excessive rate.		Amount before excessive be- gan.	Depths of precipitation (in inches) during periods of time indicated.															
		From—	To—		Began—	Ended—		5 min.	10 min.	15 min.	20 min.	25 min.	30 min.	35 min.	40 min.	45 min.	50 min.	60 min.	80 min.	100 min.	120 min.		
Ablene, Tex.....	1 9	12:10 a.m.	4:10 a.m.	0.85	2:10 a.m.	2:22 a.m.	0.30	0.23	0.41	0.45													
Albany, N. Y.....	24			0.43																*			
Alpena, Mich....	23			0.48																*			
Amarillo, Tex....	28			0.02																0.01			
Anneton, Ala.....	1	3:45 p.m.	D. N.	1.42	6:11 p.m.	6:31 p.m.	0.40	0.18	0.43	0.52	0.59												
Asheville, N. C....	31			1.01																0.24			
Atlanta, Ga.....	1-2	7:03 p.m.	2:25 a.m.	1.38	8:09 p.m.	8:37 p.m.	0.30	0.11	0.22	0.29	0.40	0.56	0.63										
Atlantic City, N. J.	19-20			0.68																0.27			
Augusta, Ga.....	14			0.64																*			
Baltimore, Md....	12-13			0.82																0.31			
Bentonville, Ark..	12	8:45 p.m.	9:40 p.m.	0.40	9:04 p.m.	9:13 p.m.	0.01	0.26	0.39	0.39													
Binghamton, N. Y..	5			0.28																0.11			
Birmingham, Ala..	1	2:17 p.m.	7:40 p.m.	1.70	4:00 p.m.	5:30 p.m.	0.07	0.05	0.09	0.16	0.45	0.53	0.60	0.69	0.75	0.81	0.85			1.33	1.45		
Bismarck, N. Dak...	26			0.47																*			
Block Island, R. I..	2			0.62																*			
Boise, Idaho.....	25			0.40																*			
Boston, Mass.....	13			0.24																0.11			
Buffalo, N. Y.....	27			0.22																0.11			
Cairo, Ill.....	13			0.87																0.55			
Canton, N. Y.....	27			0.23																0.18			
Charles City, Iowa.	28	6:33 p.m.	8:31 p.m.	1.00	7:23 p.m.	8:00 p.m.	0.15	0.10	0.15	0.19	0.25	0.29	0.52	0.75	0.80								
Charleston, S. C....	15			0.46																0.31			
Charlotte, N. C....	14			0.64																0.34			
Chattanooga, Tenn.	1			1.05																0.41			
Cheyenne, Wyo....	11-12			0.23																*			
Chicago, Ill.....	28			0.92																*			
Cincinnati, Ohio... {	12-13	3:20 p.m.	7:25 a.m.	2.97	{ 11:16 p.m. 1:08 a.m.	{ 11:23 p.m. 1:26 a.m.	{ 0.71 1.58	{ 0.24 0.09	{ 0.31 0.23	{ } 0.36	{ } 0.40	{ }	{ }	{ }	{ }	{ }	{ }	{ }	{ }	{ }	{ }	{ }	
					{ 3:29 a.m. 5:14 p.m.	{ 3:44 a.m. 6:04 p.m.	{ 2.56 0.12	{ 0.09 0.09	{ 0.30 0.10	{ 0.36 0.16	{ 0.36 0.25	{ } 0.31	{ }	{ }	{ }	{ }	{ }	{ }	{ }	{ }	{ }	{ }	
					{ 6:04 p.m. 7:13 p.m.	{ 6:35 p.m. 7:31 p.m.	{ } 1.81	{ 0.97 0.11	{ 1.06 0.27	{ 1.13 0.42	{ 1.32 0.60	{ 1.35 0.60	{ 1.47	{ }	{ }	{ }	{ }	{ }	{ }	{ }	{ }	{ }	
Cleveland, Ohio..	26-27			0.43																0.33			
Columbia, Mo.....	12-13			0.50																0.26			
Columbia, S. C....	31			0.28																0.11			
Columbus, Ohio..	27			0.66																0.34			
Concord, N. H.....	24			0.37																*			
Corpus Christi, Tex.	30			0.49																0.29			
Davenport, Iowa..	28-29			0.41																0.34			
Del Rio, Tex.....	14			0.10																*			
Denver, Colo.....	12-13			0.52																*			
Des Moines, Iowa..	26			0.65																*			
Detroit, Mich.....	9			0.20																0.17			
Dodge, Kans.....	9			0.25																*			
Dubuque, Iowa....	28-29			0.52																0.27			
Duluth, Minn.....	23			0.38																*			
Eastport, Me.....	28			0.17																0.06			
Elkins, W. Va.....	19			1.25																0.58			
Erie, Pa.....	26-27			1.63																0.79			
Escanaba, Mich....	23			0.56																*			
Evansville, Ind....	12-13			2.16																0.43			
Fort Smith, Ark....	9			1.39																*			
Fort Worth, Tex....	14			0.30																0.16			
Galveston, Tex....	30			1.79																0.60			
Grand Haven, Mich.	1			0.86																0.36			
Grand Rapids, Mich.	1-2			0.84																0.34			
Green Bay, Wis....	29			0.02																*			
Hannibal, Mo.....	12			0.56																0.39			
Harrisburg, Pa....	13-14			0.52																0.27			
Hartford, Conn....	14			0.26																*			
Hatteras, N. C....	15			0.60																0.37			
Huron, S. Dak.....	23			0.23																0.23			
Indianapolis, Ind..	26-27			0.57																0.23			
Iola, Kans.....	27-28			1.01																0.23			
Jacksonville, Fla..	2			0.64																0.51			
Jupiter, Fla.....	2			0.11																0.07			
Kansas City, Mo....	9			1.23																0.18			
Keokuk.....	28	3:55 p.m.	4:25 p.m.	2.38	3:39 p.m.	4:23 p.m.	0.01	0.53	0.85	1.14	1.43	1.51	1.57	1.72	2.23	2.36							
Key West, Fla.....	14			T.																T.			
Knoxville, Tenn....	14			1.11																0.62			
La Crosse, Wis....	28-29			0.62																0.35			
La Salle, Ill.....	28			1.18																0.33			
Lexington, Ky.....	13-14			1.56																0.53			
Lincoln, Nebr.....	9			0.53																*			
Little Rock, Ark....	28-1	9:20 p.m.	D. N.	1.42	1:10 a.m.	1:26 a.m.	0.93	0.16	0.30	0.40										0.55			
Los Angeles, Cal....	3-5			2.27																0.47			
Louisville, Ky.....	13-14			2.07																0.15			
Lynchburg, Va.....	8			0.22																0.44			
Macon, Ga.....	14			0.76																*			
Madison, Wis.....	28-29			0.83																*			
Marquette, Mich....	23-24			0.50																*			
Memphis, Tenn....	13-14	8:30 p.m.	D. N.	0.75	8:35 p.m.	8:47 p.m.	0.02	0.20	0.34	0.35													
Meridian, Miss....	1	12:40 p.m.	4:45 p.m.	1.48	3:07 p.m.	3:37 p.m.	0.41	0.23	0.38	0.72	0.92	0.97	1.03							0.29			
Milwaukee, Wis....	23	4:43 p.m.	5:10 p.m.	0.45	4:44 p.m.	4:54 p.m.	0.01	0.30	0.40														
Minneapolis, Minn..	28-29			0.18																0.07			
Mobile, Ala.....	14	4:15 p.m.	5:45 p.m.	0.67	4:32 p.m.	5:02 p.m.	0.01	0.07	0.17	0.21	0.33	0.52	0.63							*			
Montgomery, Ala..	17	9:15 a.m.	3:00 p.m.	1.22	12:33 p.m.	1:21 p.m.	0.18	0.16	0.26	0.48	0.64	0.72	0.78							0.44			
Mount Weather, Va.	1			0.60																0.23			
Nantucket, Mass....	19			0.85																0.38			
Nashville, Tenn....	13-14	10:50 p.m.	4:00 a.m.	1.30	11:33 p.m.	11:59 p.m.	0.03	0.23	0.37	0.48	0.53	0.60											
New Haven, Conn..	19			0.61																0.16			
New Orleans, La....	30	10:36 a.m.	11:55 a.m.	0.85	10:43 a.m.	10:57 a.m.	0.01	0.27	0.52	0.73										0.29			
New York, N. Y.....	19			1.03																*			
Norfolk, Va.....	14	9:05 p.m.	9:35 p.m.	0.35	9:06 p.m.	9:16 p.m.	0.01	0.20	0.30											*			
Northfield, Vt.....	24			0.78																*			
North Head, Wash..	20-21			0.66																0.14			
Oklahoma, Okla....	28			0.18																0.18			
Omaha, Nebr.....	13			0.21																*			
Palestine, Tex.....	29-30			1.30							</												

TABLE IV.—Accumulated amounts of precipitation for each 5 minutes, etc.—Continued.

Stations.	Date.	Total duration.		Total amount of precipitation.	Excessive rate.		Amount before excessive began.	Depths of precipitation (in inches) during periods of time indicated.													
		From—	To—		Began—	Ended—		5 min.	10 min.	15 min.	20 min.	25 min.	30 min.	35 min.	40 min.	45 min.	50 min.	60 min.	80 min.	100 min.	120 min.
Parkersburg, W. Va.	12-13			1.50														0.42			
Pensacola, Fla.	14			0.22														0.22			
Peoria, Ill.	28			0.68														*			
Philadelphia, Pa.	13			0.30														0.18			
Pittsburg, Pa.	26			0.58														0.37			
Portland, Me.	14			0.47														0.17			
Portland, Oreg.	22-23			0.95														0.16			
Pueblo, Colo.	13			0.12														*			
Raleigh, N. C.	31-1 <sup>b</sup>			1.00														0.52			
Richmond, Va.	14-15			0.66														0.20			
Rochester, N. Y.	12			0.25														*			
Sacramento, Cal.	22-23			1.51														0.29			
St. Louis, Mo.	11			0.48														0.35			
St. Paul, Minn.	28-1			0.38														0.07			
Salt Lake City, Utah	12			0.60														*			
San Antonio, Tex.	29-30	9:00 p. m.	4:30 a. m.	1.56	9:42 p. m.	9:55 p. m.	0.02	0.16	0.33	0.35											
San Diego, Cal.	5			0.41	11:06 p. m.	11:16 p. m.	0.51	0.23	0.38									0.28			
Sandusky, Ohio	27-28			1.18																	
San Francisco, Cal.	8-9			0.81														0.41			
Savannah, Ga.	2			0.22														0.18			
Scranton, Pa.	8			0.29														*			
Seattle, Wash.	31			0.13														0.10			
Shreveport, La.	13-14			1.48														0.51			
Spokane, Wash.	19-20			0.47														0.16			
Springfield, Ill.	27	D. N.	D. N.	0.53	3:00 a. m.	3:19 a. m.	0.08	0.14	0.35	0.40											
Springfield, Mo.	27	8:30 p. m.	8:58 p. m.	0.35	8:40 p. m.	8:45 p. m.	0.02	0.33										*			
Syracuse, N. Y.	28-29			0.54														*			
Tampa, Fla.	5-6			0.40														T.			
Taylor, Tex.	11			T.														T.			
Thomasville, Ga.	29-30			1.50														0.29			
Toledo, Ohio	2	D. N.	5:10 a. m.	0.62	2:24 a. m.	2:35 a. m.	0.02	0.31	0.40												
Topeka, Kans.	18-19			0.44														0.21			
Valentine, Nebr.	8-9			1.33														0.19			
Vicksburg, Miss.	4			0.34														*			
Washington, D. C.	1	9:10 a. m.	11:45 a. m.	0.62	9:17 a. m.	9:27 a. m.	0.01	0.25	0.34									0.24			
Wichita, Kans.	19			0.74														0.27			
Wilmington, N. C.	9			0.49														0.15			
Wytheville, Va.	15			0.26														0.23			
Yankton, S. Dak.	7-8			0.77														*			
San Juan, Porto Rico	6			0.17														*			
	15			0.62														0.32			

\* Self-register not working (a) Of February. (b) Of April.

TABLE V.—Data furnished by the Canadian Meteorological Service, March, 1907.

Stations.	Pressure, in inches.			Temperature.				Precipitation.			Stations.	Pressure, in inches.			Temperature.				Precipitation.		
	Actual, reduced to mean of 24 hours.	Sea level, reduced to mean of 24 hours.	Departure from normal.	Mean.	Departure from normal.	Mean maximum.	Mean minimum.	Total.	Departure from normal.	Total snowfall.		Actual, reduced to mean of 24 hours.	Sea level, reduced to mean of 24 hours.	Departure from normal.	Mean.	Departure from normal.	Mean maximum.	Mean minimum.	Total.	Departure from normal.	Total snowfall.
St. John's, N. F.	29.64	29.78	-0.10	24.1	-3.6	31.5	16.7	6.11	+1.35	2.2	Parry Sound, Ont.	29.31	30.02	-0.00	28.5	+7.4	38.4	18.6	3.00	+1.37	12.4
Sydney, C. B. I.	29.93	29.97	+0.09	22.6	-3.6	32.0	13.2	4.70	-0.23	37.0	Port Arthur, Ont.	29.31	30.04	-0.01	21.8	+5.0	32.9	10.8	1.63	+0.66	15.0
Halifax, N. S.	29.88	29.99	+0.05	28.2	-0.8	36.4	20.1	3.38	-2.10	10.3	Winnipeg, Man.	29.11	29.97	-0.12	17.3	+5.0	28.2	6.5	1.12	+0.09	11.2
Grand Manan, N. B.	29.94	29.99	+0.06	30.1	+0.3	36.5	23.6	2.16	-2.12	7.3	Minneapolis, Minn.	28.06	29.98	-0.08	17.6	+8.1	29.2	6.1	0.86	+0.21	6.7
Yarmouth, N. S.	29.94	30.01	+0.06	30.5	-0.3	36.6	24.3	2.22	-2.63	8.5	Qu'Appelle, Sask.	27.62	29.95	-0.09	17.6	+2.7	27.4	7.7	0.95	+0.18	9.5
Charlottetown, P. E. I.	29.93	29.97	+0.07	22.2	-3.2	30.0	14.5	2.31	-0.90	14.1	Medicine Hat, Alberta.	27.54	29.87	-0.13	26.4	+1.1	36.6	16.1	0.51	+0.25	3.6
Chatham, N. B.	29.95	29.97	+0.07	22.7	-0.3	36.1	9.3	3.43	-0.04	30.8	Swift Current, Sask.	27.30	29.98	-0.04	19.7	+2.3	28.8	10.5	0.86	+0.05	5.4
Father Point, Que.	29.95	29.98	+0.08	20.6	+0.3	30.0	11.2	2.14	-0.59	17.4	Calgary, Alberta.	26.25	29.90	-0.05	22.1	+4.1	33.1	11.1	0.76	+0.04	7.6
Quebec, Que.	29.70	30.04	+0.08	24.0	+2.8	32.2	15.9	3.38	+0.12	19.4	Banff, Alberta.	25.17	29.89	-0.05	22.3	+5.7	33.7	10.8	1.55	+0.14	14.4
Montreal, Que.											Edmonton, Alberta.										
Rockville, Ont.	29.39	30.02	+0.01	23.3	+4.3	36.4	10.3	1.92	-0.14	8.6	Prince Albert, Sask.	27.32	29.95	-0.13	12.9	+0.9	25.9	-0.1	1.82	+1.05	8.2
Ottawa, Ont.	29.65	29.99	-0.02	27.0	+5.5	35.2	18.8	2.38	-0.34	14.5	Battleford, Sask.	28.13	29.94	-0.12	14.0	+0.9	24.9	3.0	0.52	+0.06	5.2
Kingston, Ont.	29.73	30.05	+0.04	30.6	+5.0	37.3	24.1	0.94	-1.70	1.5	Kamloops, B. C.	28.62	29.86	-0.06	35.9	+0.2	44.6	27.1	0.24	-0.33	1.4
Toronto, Ont.	29.65	30.05	+0.03	33.8	+6.5	41.4	26.3	2.15	-0.49	3.4	Victoria, B. C.	29.80	29.90	-0.07	42.4	+0.5	49.6	35.2	1.40	-1.72	T.
White River, Ont.											Barkerville, B. C.										
Port Stanley, Ont.	29.40	30.06	+0.03	34.6	+7.4	41.5	27.7	2.78	-0.10	7.9	Hamilton, Bermuda.	29.95	30.12	+0.04	62.6	+0.4	67.8	57.4	1.58	-3.55	
Saugeen, Ont.	29.31	30.04	+0.01	31.3	+6.6	40.4	22.3	2.64	-0.01	6.1	Dawson, Yukon										

TABLE VI.—Heights of rivers referred to zeros of gages, March, 1907.

Stations.	Distance to mouth of river.	Flood stage on gage.	Highest water.		Lowest water.		Mean stage.	Monthly range.	Stations.	Distance to mouth of river.	Flood stage on gage.	Highest water.		Lowest water.		Mean stage.	Monthly range.
			Height.	Date.	Height.	Date.						Height.	Date.	Height.	Date.		
Milk River.	Miles.	Feet.	Feet.		Feet.		Feet.	Feet.	Republican River.	Miles.	Feet.	Feet.		Feet.		Feet.	Feet.
Havre, Mont. (20)	237	9	10.2	24	5.4	30	6.8	4.8	Clay Center, Kans.	42	18	6.9	5	6.1	30, 31	6.4	0.8
Yellowstone River.									Solomon River.								
Billings, Mont. (2)	330	8	1.2	25	0.2	16-18	0.6	1.0	Beloit, Kans.	75	16	1.7	{9, 11, 13, 2}	0.6	1, 30, 31	1.1	1.1
Cheyenne River.																	
Rosseau, S. Dak. (20)	12	9	3.9	22	1.8	31	2.9	2.1	Smoky Hill-Kansas River.								
James River.									Landsburg, Kans.	341	20	2.2	5	1.4	17, 20, 29	1.7	0.8
Lamoure, N. Dak. (2)	330	14	6.4	27	0.7	16-21	3.3	5.7	Abilene, Kans.	277	22	1.4	12	0.4	26-28	0.7	1.0
Huron, S. Dak. (2)	199	9	13.9	26, 27	4.9	13, 14	9.6	9.0	Manhattan, Kans.	116	18	5.4	11	3.5	31	4.3	1.9
Big Blue River.									Topeka, Kans.	87	21	10.6	10	6.8	28-31	7.6	3.8
Beatrice, Nebr.	92	14	3.1	12	2.3	21-31	2.5	0.8	Ozage River.								
Blue Rapids, Kans.	47	14	5.5	6	3.6	30, 31	4.4	1.9	Bagnell, Mo.	70	28	7.8	30	2.3	1	4.5	5.5

TABLE VI.—Heights of rivers referred to zeros of gages—Continued.

Stations.	Distance to mouth of river.	Flood stage on gage.	Highest water.		Lowest water.		Mean stage.	Monthly range.	Stations.	Distance to mouth of river.	Flood stage on gage.	Highest water.		Lowest water.		Mean stage.	Monthly range.
			Height.	Date.	Height.	Date.						Height.	Date.	Height.	Date.		
<i>Gasconade River.</i>	Miles.	Feet.	Feet.		Feet.		Feet.	Feet.	<i>Tennessee River—Cont'd.</i>	Miles.	Feet.	Feet.		Feet.		Feet.	Feet.
Arlington, Mo.	98	16	3.5	14	1.2	25-27, 31	1.7	2.3	Kingston, Tenn.	556	25	12.0	3	3.0	30, 31	6.3	9.0
<i>Missouri River.</i>									Chattanooga, Tenn.	482	33	18.4	4	5.0	31	10.1	13.4
Townsend, Mont. (*)	2,504	11	4.8	22-24	4.0	16-18	4.4	0.8	Bridgeport, Ala.	402	24	15.2	4	3.3	31	8.0	11.9
Fort Benton, Mont. (*)	2,285	12	3.0	25, 26	1.8	16-18, 20	2.3	1.2	Guntersville, Ala.	349	31	21.8	5	6.5	30, 31	13.4	15.3
Wolfpoint, Mont. (*)	1,952	17	9.7	26	6.6	28		3.1	Florence, Ala.	255	16	14.5	5, 6	3.7	31	8.9	10.8
Bismarck, N. Dak.	1,309	14	9.4	4, 5	6.1	30	7.8	3.3	Riverton, Ala.	225	26	24.5	5	6.4	31	14.9	18.1
Pierre, S. Dak. (*)	1,114	14	6.5	9	4.0	19	4.6	2.5	Johnsonville, Tenn.	95	21	25.4	5	9.3	31	17.8	16.1
St. Louis, Iowa. (*)	784	17	14.5	14	8.4	3, 4	10.2	6.1	<i>Ohio River.</i>								
Blair, Nebr.	705	15	11.4	15	7.1	4, 5	8.8	4.3	Pittsburg, Pa.	966	22	33.5	15	4.7	9	11.6	30.8
Omaha, Nebr.	669	18	14.5	16	9.8	4	11.6	4.7	Dam No. 2, Pa.	956	25	36.8	15	6.0	9	12.1	30.8
Plattsmouth, Nebr.	641	17	7.0	16	4.2	4	5.2	2.8	Beaver Dam, Pa.	925	27	47.1	15	8.6	26	17.2	38.5
St. Joseph, Mo.	481	10	7.8	17	3.8	5, 6	5.6	4.0	Wheeling, W. Va.	875	36	50.1	15	8.1	1	19.2	42.0
Kansas City, Mo.	388	21	15.4	17	10.7	6, 7	12.7	4.7	Parkersburg, W. Va.	785	36	51.6	16	9.6	10	22.6	42.0
Glasgow, Mo.	231	18	12.3	19	8.4	7	9.9	3.9	Point Pleasant, W. Va.	703	39	54.8	18	12.4	1	27.8	42.4
Boonville, Mo.	199	20	14.7	19	10.3	28	12.6	4.4	Huntington, W. Va.	660	50	58.4	18	18.0	1	32.8	40.4
Hermann, Mo.	103	24	13.8	20	9.6	9	11.5	4.2	Cattlettsburg, Ky.	651	50	60.4	18	19.0	1	34.0	41.4
<i>Minnesota River.</i>									Portsmouth, Ohio.	612	50	60.8	17, 18	19.5	1	35.7	41.3
Mankato, Minn.	127	18	8.8	23	4.4	11-15	6.3	4.4	Maysville, Ky.	559	50	59.2	18	19.3	1	35.8	39.9
<i>St. Croix River.</i>									Cincinnati, Ohio.	499	50	62.1	19	22.3	1	40.1	39.8
Stillwater, Minn. (N)	23	11	12.7	31	5.9	22		6.8	Madison, Ind.	413	46	51.9	19	21.3	1	35.5	30.6
<i>Chippewa River.</i>									Louisville, Ky.	367	28	36.0	20	8.7	1	19.6	27.3
Chippewa Falls, Wis. (N)	75	16	11.0	30	1.7	19	5.3	9.3	Evansville, Ind.	184	35	43.8	23	20.5	1	34.4	23.3
<i>Red Cedar River.</i>									Mount Vernon, Ind.	148	35	45.0	24, 25	19.0	1	35.1	26.0
Cedar Rapids, Iowa	77	14	6.6	6	4.4	13, 14	4.8	2.2	Paducah, Ky.	47	40	42.3	25	21.3	1	35.1	21.0
<i>Des Moines River.</i>									Cairo, Ill.	1	45	46.2	24	29.1	1	40.2	17.1
Des Moines, Iowa	203	19	4.3	30	2.8	11, 12	3.5	1.5	<i>St. Francis River.</i>								
<i>Illinois River.</i>									Marked Tree, Ark.	104	17	16.6	14-16	15.3	1, 31	16.1	1.3
La Salle, Ill.	197	18	20.4	31	15.8	11, 12	17.4	4.6	<i>Neosho River.</i>								
Peoria, Ill.	135	14	14.3	31	12.7	12	13.8	1.6	Neosho Rapids, Kans.	326	22	14.1	11	1.8	29-31	4.5	12.3
Beardstown, Ill.	70	12	13.5	22-25	11.9	11	12.7	1.6	Iola, Kans.	262	10	5.3	12	0.9	26-28, 31	2.1	4.4
<i>Clinton River.</i>									Oswego, Kans.	184	20	8.8	14	0.8	1	2.9	8.0
Clinton, Pa.	32	10	8.5	15	2.8	11, 12	4.6	5.7	Fort Gibson, Ind. T.	3	22	14.0	16	9.0	24	10.7	5.0
<i>Conemaugh River.</i>									<i>Canadian River.</i>								
Johnstown, Pa.	64	7	18.0	14	1.9	11	4.5	16.1	Calvin, Ind. T.	99	10	5.6	9	2.2	27, 28	2.9	3.4
<i>Allegheny River.</i>									<i>Black River.</i>								
Warren, Pa. (1)	177	14	7.2	28	1.4	2-11	4.1	5.8	Blackrock, Ark.	67	12	18.2	2	10.9	31	15.0	7.3
Franklin, Pa. (1)	114	15	10.8	14	4.1	12	6.8	6.7	<i>White River.</i>								
Parker, Pa. (14)	73	20	18.0	14	5.2	26	6.7	12.4	Calico Rock, Ark.	272	15	8.5	15	2.9	30, 31	5.5	5.6
Freeport, Pa.	29	20	28.0	15	4.0	1	10.8	24.0	Batesville, Ark.	217	18	11.0	15	4.9	31	7.9	6.1
Springdale, Pa.	17	27	32.4	15	8.4	1	15.2	24.0	Newport, Ark.	185	26	19.3	17	10.6	31	16.6	8.7
<i>Cheat River.</i>									Clarendon, Ark.	75	30	26.7	13-18	23.0	1	25.9	3.7
Rowlesburg, W. Va.	36	14	9.2	14	2.4	31	4.4	6.8	<i>Arkansas River.</i>								
<i>Youghiogheny River.</i>									Wichita, Kans.	832	10	0.6	13	0.6	27	0.1	1.2
Confluence, Pa.	59	10	18.6	14	1.9	31	4.5	16.7	Tulsa, Ind. T.	551	16	4.2	6-8	3.3	25-31	3.6	0.9
West Newton, Pa.	15	23	28.2	14	2.4	31	6.3	25.8	Webbers Falls, Ind. T.	465	23	8.0	10, 15	5.4	28, 30	6.4	2.6
<i>Monongahela River.</i>									Fort Smith, Ark.	403	22	12.1	11	4.5	29-31	7.0	7.6
Weston, W. Va.	161	18	8.7	14	0.4	29-31	1.2	9.1	Dardanelle, Ark.	256	21	12.4	12	4.2	31	7.2	8.2
Fairmont, W. Va.	119	25	25.6	14	14.9	31	17.5	10.7	Little Rock, Ark.	176	23	14.0	13	5.7	31	9.6	8.3
Greensboro, Pa.	81	18	27.9	14	7.8	31	11.7	20.1	Pine Bluff, Ark.	121	23	16.2	14	8.1	31	12.2	8.1
Lock No. 4, Pa.	40	28	37.4	14	7.7	31	14.5	29.7	<i>Yazoo River.</i>								
<i>Beaver River.</i>									Greenwood, Miss.	175	38	29.6	24-26	18.5	1	26.8	11.1
Ellwood Junction, Pa.	10	14	11.0	14	2.3	10, 11	4.4	8.7	Yazoo City, Miss.	80	25	23.1	1	20.5	12-14	21.5	2.6
<i>Muskingum River.</i>									<i>Ouachita River.</i>								
Zanesville, Ohio	70	25	31.9	14	9.5	1	16.4	22.4	Camden, Ark.	304	30	32.6	6	8.1	30	20.2	24.5
Beverly, Ohio (*)	20	25	34.0	14	7.6	1	15.5	26.4	Monroe, La.	122	40	34.7	28, 29	29.1	5-7	31.8	5.6
<i>Little Kanawha River.</i>									<i>Red River.</i>								
Glenville, W. Va.	77	20	13.6	20	0.6	30	3.4	13.0	Denison, Tex.	768	22	7.9	12	1.2	9	2.9	6.7
Creston, W. Va.	58	20	20.4	14	3.5	6	6.6	16.9	Arthur City, Tex.	688	27	16.0	13	7.9	29-31	10.3	8.1
<i>New-Great Kanawha River.</i>									Fulton, Ark.	515	28	23.8	15	10.3	31	17.1	13.5
Radford, Va.	213	14	3.2	6	0.7	20, 21, 23-26	1.6	2.5	Shreveport, La.	327	29	15.0	17	4.6	1	11.1	10.4
Hinton, W. Va.	153	14	6.5	15	2.5	29, 30	4.2	4.0	Alexandria, La.	118	33	22.4	20, 21	11.4	1	18.5	11.0
Charleston, W. Va.	58	30	20.9	15	4.8	29	9.6	16.1	<i>Mississippi River.</i>								
<i>Savannah River.</i>									Fort Ripley, Minn. (N)	2,082	10	11.8	30				
Columbus, Ohio (1)	110	17	19.0	14	3.0	8-12	6.1	16.0	St. Paul, Minn. (N)	1,954	14	12.3	31	5.8			6.5
<i>Licking River.</i>									Red Wing, Minn. (N)	1,914	14	9.7	31	6.1			3.6
Falmouth, Ky.	36	25	28.1	14	2.0	31	9.2	26.1	Reeds Landing, Minn.	1,884	12	9.3	31	2.2	10-15	4.0	7.1
<i>Miami River.</i>									La Crosse, Wis. (N)	1,819	12	10.2	31	7.2	26		3.0
Dayton, Ohio	77	18	15.2	14	2.0	29-31	4.3	13.2	Prairie du Chien, Wis. (N)	1,759	18	9.4	31				
<i>Kentucky River.</i>								</									

TABLE VI.—Heights of rivers referred to zeros of gages—Continued.

Stations.	Distance to mouth of river.	Flood stage on gage.	Highest water.		Lowest water.		Mean stage.	Monthly range.	Stations.	Distance to mouth of river.	Flood stage on gage.	Highest water.		Lowest water.		Mean stage.	Monthly range.
			Height.	Date.	Height.	Date.						Height.	Date.	Height.	Date.		
<i>Grand River—Cont'd.</i>	<i>Miles.</i>	<i>Feet.</i>	<i>Feet.</i>		<i>Feet.</i>		<i>Feet.</i>	<i>Feet.</i>	<i>Edisto River.</i>	<i>Miles.</i>	<i>Feet.</i>	<i>Feet.</i>		<i>Feet.</i>		<i>Feet.</i>	<i>Feet.</i>
Grand Rapids, Mich.....	38	11	8.3	16	4.3	1	6.8	4.0	Edisto, S. C.....	75	6	4.7	7	2.4	31	3.4	2.3
<i>Sandusky River.</i>									<i>Broad River.</i>								
Tiffin, Ohio.....	65	7	8.0	15	0.8	11	2.9	7.2	Carlton, Ga.....	30	11	6.3	3	2.5	30, 31	3.2	3.8
<i>Penobscot River.</i>									<i>Savannah River.</i>								
Mattawamkeag, Me. (21).....	87								Calhoun Falls, S. C.....	347	15	5.0	2	2.4	30, 31	3.5	2.6
West Enfield, Me. (21).....	60								Augusta, Ga.....	268	32	17.0	4	8.0	31	10.0	9.0
<i>Kennebec River.</i>									<i>Oconee River.</i>								
Winslow, Me.....	46	8	6.2	31	4.0	3, 16, 17	4.7	2.2	Milledgeville, Ga.....	147	25	12.9	3	3.1	31	5.1	9.8
<i>Merrimac River.</i>									Dublin, Ga.....	79	30	9.5	7	0.7	3	3.9	8.8
Franklin June, N. H. (4) (b).....	110	13	12.1	31	3.9	10-12	4.7	8.2	<i>Ocmulgee River.</i>								
Concord, N. H. (16).....	94	10	5.5	31	1.2	17	2.2	4.3	Macon, Ga.....	203	18	13.7	3	3.0	31	5.6	10.7
Manchester, N. H.....	68	8	4.5	31	1.1	2	2.5	3.4	Abbeville, Ga.....	96	11	10.3	10	3.7	31	6.4	6.6
<i>Connecticut River.</i>									<i>Flint River.</i>								
Wells River, Vt. (22).....	255	34	28.8	31					Woodbury, Ga.....	227	10	4.0	4	0.7	28-31	1.5	3.3
Whiteriver Junction, Vt. (22).....	209		14.1	31					Montezuma, Ga.....	152	20	10.2	5	2.9	28	5.5	7.3
Bellows Falls, Vt.....	170	12	7.8	31	— 0.9	3	2.2	8.7	Albany, Ga.....	90	20	7.4	8	1.7	31	4.2	5.7
Holyoke, Mass.....	84	9	7.4	31	0.2	14	2.4	7.2	Bainbridge, Ga.....	29	22	8.0	9	3.7	31	5.7	4.3
Hartford, Conn. (17).....	50	16	15.1	31	6.4	23		8.7	<i>Chattahoochee River.</i>								
<i>Housatonic River.</i>									Oakdale, Ga.....	305	18	13.8	3	3.0	{23, 24, 26-}	5.0	10.8
Gaylordsville, Conn.....	44	15	6.7	18, 19	3.8	12, 13	5.1	2.9	West Point, Ga.....	239	20	13.0	3	3.4	31	5.0	9.6
<i>Mohawk River.</i>									Eufaula, Ala.....	90	40	22.0	3	4.3	31	9.7	17.7
Utica, N. Y.....	98	6	10.5	24	2.0	6, 7	5.5	8.5	Alaga, Ala.....	30	25	21.7	5	5.5	31	9.9	16.2
Tribes Hill, N. Y.....	42	12	6.4	21, 22	0.4	1, 12	3.1	6.0	<i>Oosa River.</i>								
Schenectady, N. Y.....	19	15	8.5	30	1.2	6-11	4.2	7.3	Rome, Ga.....	266	30	21.6	3	2.8	28-31	6.1	18.8
<i>Hudson River.</i>									Gadsden, Ala.....	162	22	20.2	4	3.6	29-31	8.3	16.6
Glens Falls, N. Y.....	197	20	8.7	31	3.3	15	4.4	5.4	Lock No. 4, Ala.....	113	17	16.2	3, 4	2.8	30, 31	6.8	13.4
Troy, N. Y.....	154	14	16.2	27	3.2	9	7.8	13.0	Wetumpka, Ala.....	12	45	35.3	4	7.0	30, 31	15.4	28.3
Albany, N. Y.....	147	12	10.8	31	1.9	10	5.0	8.9									
Stuyvesant, N. Y.....	128	9	8.5	18	1.0	11	3.7	4.5	<i>Tallahassee River.</i>								
<i>Pompton River.</i>									Milstead, Ala.....	42	35	26.0	3	3.4	30, 31	7.4	22.6
Pompton Plains, N. J. (12).....	6	8	5.7	19	4.3	13	5.1	1.4	<i>Alabama River.</i>								
<i>Passaic River.</i>									Montgomery, Ala.....	323	35	33.8	5	4.8	31	13.3	29.0
Chatham, N. J. (13).....	69	7	9.0	18	3.0	31	5.0	6.0	Selma, Ala.....	246	35	37.5	6	6.1	31	16.8	31.4
<i>Lehigh River.</i>									<i>Black Warrior River.</i>								
Mauch Chunk, Pa. (14).....	45	15	7.2	18	4.5	31	5.7	2.7	Tuscaloosa, Ala.....	90	43	50.2	3	7.4	31	19.1	42.8
<i>Schuylkill River.</i>									<i>Tombigbee River.</i>								
Reading, Pa.....	66	12	6.8	15	0.3	1	2.1	6.5	Columbus, Miss.....	316	33	16.3	6	— 0.2	31	7.1	16.5
<i>Delaware River.</i>									Vienna, Ala.....	246	42	28.8	6	2.4	31	13.7	26.4
Hancock (E. Branch), N. Y.....	287	12	9.5	15	4.7	21	5.8	4.8	Demopolis, Ala.....	168	35	47.3	8	5.1	31	28.1	42.2
Hancock (W. Branch), N. Y.....	287	10	7.1	15	3.8	13	5.0	3.3	<i>Leaf River.</i>								
Port Jervis, N. Y.....	215	14	7.2	24	2.1	6, 7	3.8	8.1	Hattiesburg, Miss.....	60	20	15.0	5	3.1	31	6.5	11.9
Phillipsburg, N. J. (7).....	146	26	11.5	18	1.6	9	6.2	9.9	<i>Chickasawhay River.</i>								
Trenton, N. J.....	92	18	7.0	15	3.6	31	4.8	3.4	Enterprise, Miss.....	144	18	24.0	3	2.3	31	7.5	21.7
<i>North Branch Susquehanna.</i>									Shubuta, Miss.....	106	25	34.5	5	4.5	24-31	14.8	30.0
Binghamton, N. Y.....	183	16	9.5	24	2.0	3	4.6	7.5	<i>Pascagoula River.</i>								
Towanda, Pa.....	139	16	8.9	24	3.0	13, 14	5.1	5.9	Merrill, Miss.....	78	20	20.2	8-10	4.6	31	13.6	15.6
Wilkes-Barre, Pa.....	60	17	16.0	16	3.1	12, 13	8.2	12.9	<i>Pearl River.</i>								
<i>West Branch Susquehanna.</i>									Jackson, Miss.....	242	20	27.3	8	4.6	30	16.4	22.7
Clearfield, Pa.....	165	8	11.9	14	2.1	26	3.5	9.8	Columbia, Miss.....	110	14	19.5	6	3.7	31	12.6	13.8
Renovo, Pa. (13).....	90	16	14.0	15	4.5	31	7.7	9.5	<i>Sabine River.</i>								
Williamsport, Pa.....	39	20	18.8	15	1.7	1-3	6.5	17.1	Logansport, La.....	315	25	16.6	5, 6	5.3	30	12.2	11.3
<i>Juniata River.</i>									<i>Neches River.</i>								
Huntingdon, Pa.....	90	24	14.0	14	3.3	1	5.7	10.7	Rockland, Tex.....	105	20	9.5	2	3.0	13	4.8	6.5
<i>Susquehanna River.</i>									Beaumont, Tex.....	18	10	2.3	10, 13	1.3	31	1.9	1.0
Sellingrove, Pa.....	116	17	10.0	16	1.7	2	4.9	8.3	<i>Trinity River.</i>								
Harrisburg, Pa.....	69	17	13.3	16	3.3	1, 2	6.8	10.0	Dallas, Tex.....	320	25	16.9	1	4.1	27, 28, 30, 31	5.8	12.8
<i>Shenandoah River.</i>									Long Lake, Tex.....	211	35	22.8	5	5.9	29, 31	10.8	16.9
Riverton, Va.....	58	22	— 0.5	1-31	— 0.5	1-31	— 0.5	0.0	Riverside, Tex.....	112	40	11.9	8	2.1	29, 30	5.4	9.8
<i>Potomac River.</i>									Liberty, Tex.....	20	25	12.8	11	5.5	31	8.5	7.3
Cumberland, Md.....	290	8	12.0	14	4.4	31	6.1	7.6	<i>Brazos River.</i>								
Harpers Ferry, W. Va.....	172	18	16.1	15	2.5	1	6.9	13.6	Kopperl, Tex.....	345	21	2.2	19	— 0.2	1, 2	0.4	2.4
<i>James River.</i>									Waco, Tex.....	285	24	4.1	22	2.9	20, 21	3.3	1.2
Buchanan, Va.....	365	12	6.9	1	3.3	31	4.8	3.6	Valley Junction, Tex.....	215	40	4.6	4	0.4	17-22, 27, 28	1.2	4.2
Lynchburg, Va.....	260	18	4.5	5, 15	1.8	30, 31	3.1	2.7	Hempstead, Tex.....	140	40	3.7	7	— 1.8	27, 29, 30	0.6	5.5
Columbia, Va.....	167	18	9.3	16	5.0	30, 31	7.0	4.3	Booth, Tex.....	61	39	3.8	1-3	2.1	22, 23	3.0	1.7
Richmond, Va.....	111	12	2.8	16	— 0.1	10	1.4	2.9	<i>Colorado River.</i>								
<i>Dan River.</i>									Ballinger, Tex.....	489	21	0.8	29-31	0.6	18-28	0.7	0.2
Danville, Va.....	58	8	1.1	15	— 0.1	30, 31	0.5	1.2	Austin, Tex.....	214	18	1.2	1-5	0.9	21, 22	1.1	0.3
<i>Staunton River.</i>									Columbus, Tex.....	98	24	7.4	1	6.2	23-25	6.7	1.2
Randolph, Va.....	26	28	9.3	12	8.3	27, 30, 31	6.2	4.0	<i>Guadalupe River.</i>								
<i>Roanoke River.</i>									Gonzales, Tex.....	112	22						

Honolulu, T. H., latitude 21° 19' north, longitude 157° 30' west; barometer above sea, 38 feet; gravity correction, —0.057 inch, applied. March, 1907.

Day.	Pressure.*		Air temperature.				Moisture.				Wind.				Precipitation.		Clouds.					
																	8 a. m.			8 p. m.		
	8 a. m.	8 p. m.	8 a. m.	8 p. m.	Maximum.	Minimum.	8 a. m.	8 p. m.	8 a. m.	8 p. m.	8 a. m.	8 p. m.	8 a. m.	8 p. m.	8 a. m.	8 p. m.	Amount.	Kind.	Direction.	Amount.	Kind.	Direction.
1	29.95	29.93	73.0	72.0	76	68	68.0	78	68.0	82	e.	2	ne.	4	0.00	0.02	9	S.-cu.	s.	3	S.	ne.
2	29.95	29.96	74.0	73.2	77	69	67.5	71	67.2	73	ne.	8	e.	16	0.00	0.11	9	S.-cu.	s.	7	S.	e.
3	30.05	30.06	72.0	71.5	76	70	64.5	67	66.0	75	ne.	29	ne.	20	0.00	0.00	10	S.-cu.	e.	3	Cu.	e.
4	30.06	30.06	69.2	70.0	75	65	64.0	75	65.5	79	e.	18	e.	11	T.	0.04	4	S.-cu.	e.	4	N.	e.
5	30.06	30.00	71.2	71.0	76	68	66.4	69	67.0	81	ne.	13	ne.	2	T.	0.01	4	A.-s.	e.	10	S.	ne.
6	30.00	29.91	69.2	66.5	74	66	67.0	91	66.0	97	e.	5	ne.	8	0.04	0.53	10	S.	e.	9	S.	ne.
7	29.91	29.88	72.0	71.5	74	68	68.2	83	69.0	88	se.	4	ne.	1	0.02	0.09	9	Cu.	e.	9	Cl.-s.	n.
8	29.88	29.88	72.3	69.5	78	67	69.0	86	66.0	83	ne.	2	ne.	6	0.16	0.00	1	A.-cu.	0	1	Cu.	e.
9	29.92	29.94	70.8	70.3	75	63	62.6	63	65.3	77	ne.	3	ne.	3	0.00	0.00	1	A.-cu.	0	2	Cu.	ne.
10	29.95	29.93	69.5	69.0	75	64	64.0	74	62.5	70	ne.	4	ne.	7	T.	0.00	5	Cu.	e.	0	0	0
11	29.95	29.95	70.2	68.0	75	63	63.0	58	62.5	74	ne.	3	ne.	10	0.00	T.	1	A.-cu.	0	0	0	0
12	30.06	30.04	70.2	69.0	77	63	60.8	58	62.0	67	ne.	5	ne.	12	0.00	0.00	few.	Cu.	e.	0	0	0
13	30.03	29.98	69.0	69.0	78	62	61.2	64	65.0	81	ne.	3	ne.	3	0.00	0.00	few.	Cu.	0	0	0	0
14	29.96	29.92	66.6	69.0	76	63	63.0	82	64.0	76	nw.	4	nw.	4	0.00	T.	9	S.	e.	0	0	0
15	29.94	29.94	68.0	68.5	76	64	63.0	76	63.0	74	ne.	4	ne.	9	0.02	T.	5	Cu.	e.	7	Cu.	e.
16	29.90	30.00	70.0	68.5	74	65	61.0	59	59.0	56	ne.	18	ne.	16	0.00	0.00	4	A.-cu.	0	1	S.	e.
17	30.05	30.06	69.0	68.5	73	65	59.0	55	65.0	83	ne.	22	ne.	10	0.00	0.00	7	Cl.-cu.	w.	6	S.	ne.
18	30.05	30.05	70.0	69.3	74	66	59.0	51	62.0	66	ne.	13	e.	9	0.00	0.00	4	A.-s.	0	8	A.-s.	e.
19	30.04	30.04	71.0	70.0	75	66	61.0	56	64.0	72	e.	10	ne.	8	0.00	T.	8	A.-s.	0	1	Cu.	e.
20	30.06	30.03	70.0	71.0	74	66	63.0	68	63.0	64	e.	10	ne.	15	T.	0.01	10	S.-cu.	e.	8	N.	ne.
21	30.06	30.04	72.3	71.0	76	65	64.0	64	65.0	72	e.	22	e.	17	0.03	T.	8	A.-cu.	0	8	A.-s.	ne.
22	30.04	30.05	73.0	72.0	75	68	65.0	65	64.5	67	ne.	9	e.	14	0.01	T.	2	Cu.	e.	10	Cu.	e.
23	30.07	30.05	72.0	72.0	76	66	65.0	69	64.0	65	ne.	13	e.	15	0.04	0.00	9	S.-cu.	0	5	Cu.	e.
24	30.08	30.07	73.2	71.5	78	68	64.3	61	64.0	66	e.	14	e.	8	0.00	0.00	1	Cu.	e.	5	Cu.	e.
25	30.08	30.06	72.0	69.3	77	67	63.3	62	67.3	90	ne.	17	e.	15	T.	0.02	9	Cu.	e.	6	Cu.	e.
26	30.09	30.08	67.5	70.5	74	65	65.0	88	63.5	68	e.	4	ne.	14	0.17	0.16	10	N.	e.	5	Cu.	ne.
27	30.10	30.10	72.5	71.0	76	64	63.6	61	63.0	64	ne.	13	e.	8	0.02	T.	4	Cu.	e.	7	Cu.	e.
28	30.13	30.09	72.0	69.0	75	64	62.5	59	65.0	81	e.	18	ne.	12	0.03	0.06	4	Cu.	e.	6	N.	ne.
29	30.07	30.06	72.0	71.0	77	62	63.0	61	61.2	57	ne.	16	e.	10	0.07	T.	3	Cu.	e.	4	A.-cu.	e.
30	30.08	30.08	71.8	72.0	75	63	64.0	65	64.0	65	ne.	7	e.	12	0.13	0.05	8	Cu.	e.	5	A.-s.	0
31	30.13	30.15	73.0	72.0	76	68	64.0	61	65.0	69	e.	23	e.	12	T.	T.	7	A.-cu.	w.	10	S.	e.
Mean....	30.023	30.013	70.9	70.2	75.6	65.5	63.8	67.7	64.5	73.6	ne.	10.8	ne.	10.0	0.74	1.40	6.5	Cu.	e.	5.3	Cu.	e.

Observations are made at 8 a. m. and 8 p. m., local standard time, which is that of 157° 30' west, and is 5<sup>h</sup> and 30<sup>m</sup> slower than 75th meridian time. \* Pressure values are reduced to sea level and standard gravity.

NOTE.—At the morning observation on the 28th, with four-tenths cumulus clouds and several belts of very light rain to the eastward and northward of the station, two portions of a rainbow, one extending from 50° above the northern horizon to the zenith and the other extending from the southern horizon to 30° above, were observed to the westward of the station in an apparently cloudless sky. Several viewpoints were taken, yet not a semblance of a cloud could be seen in that portion of the heavens. The colors of the segments of rainbow were very brilliant.

### RAINFALL IN JAMAICA<sup>1</sup>

Thru the kindness of Dr. H. H. Cousins, chemist to the government of Jamaica and now in charge of the meteorological service of that island, we have received the following table:

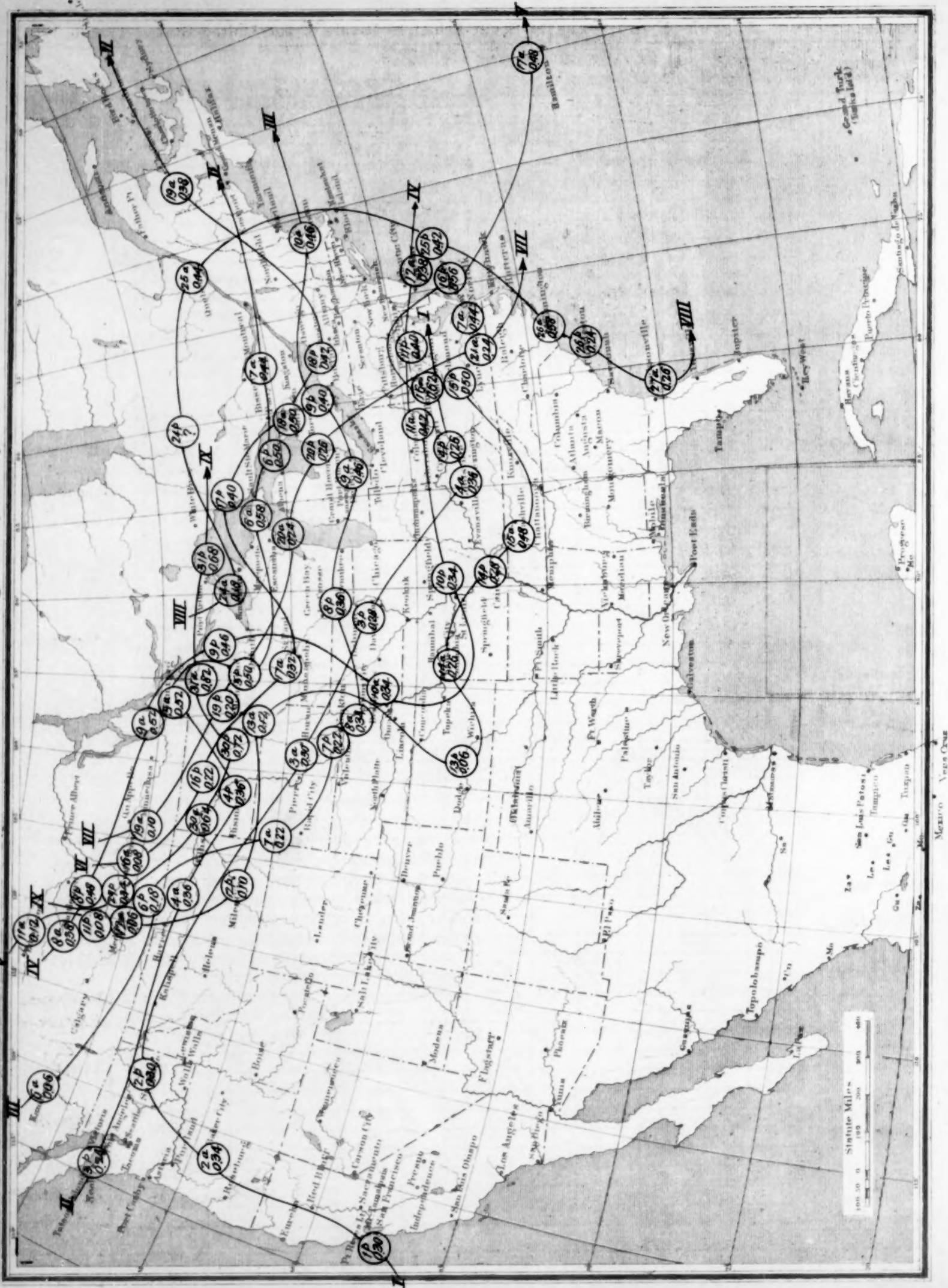
The rainfall for February was therefore above the average for the whole island. The greatest fall, 13.80 inches, occurred at Mount Holstein in the northeastern division, while no rain fell at Sandy Bay, in the northern division.

<sup>1</sup> Received too late for publication in the February Review.

Comparative table of rainfall.  
[Based upon the average stations only.]  
FEBRUARY, 1907.

Divisions.	Relative area.	Number of stations.	Rainfall.	
			1906.	Average.
	Per cent.		Inches.	Inches.
Northeastern division .....	25	22	4.71	5.52
Northern division .....	22	49	3.18	2.48
West-central division .....	26	21	3.89	2.39
Southern division .....	27	31	3.21	1.69
Means .....	100		3.75	3.02





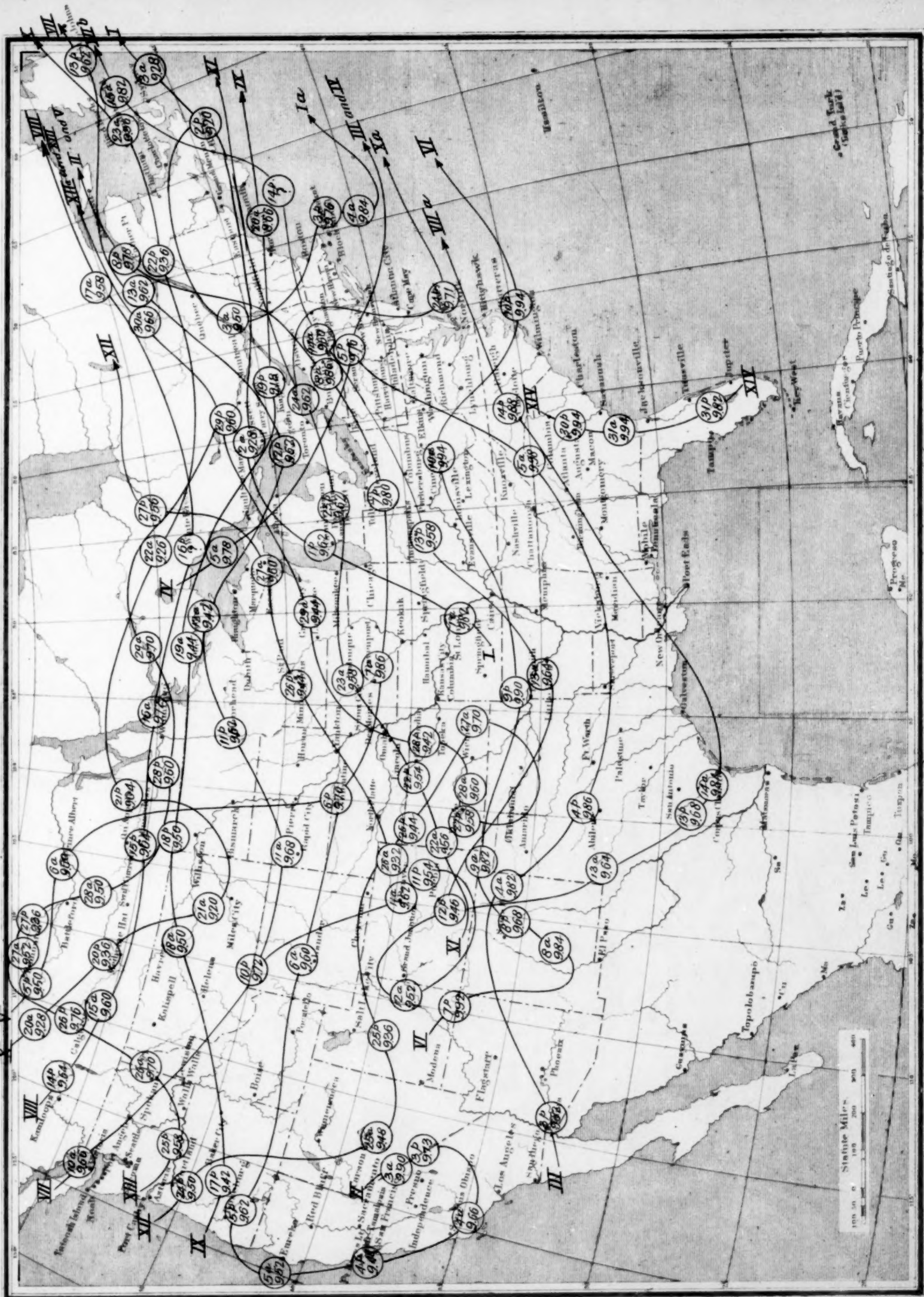
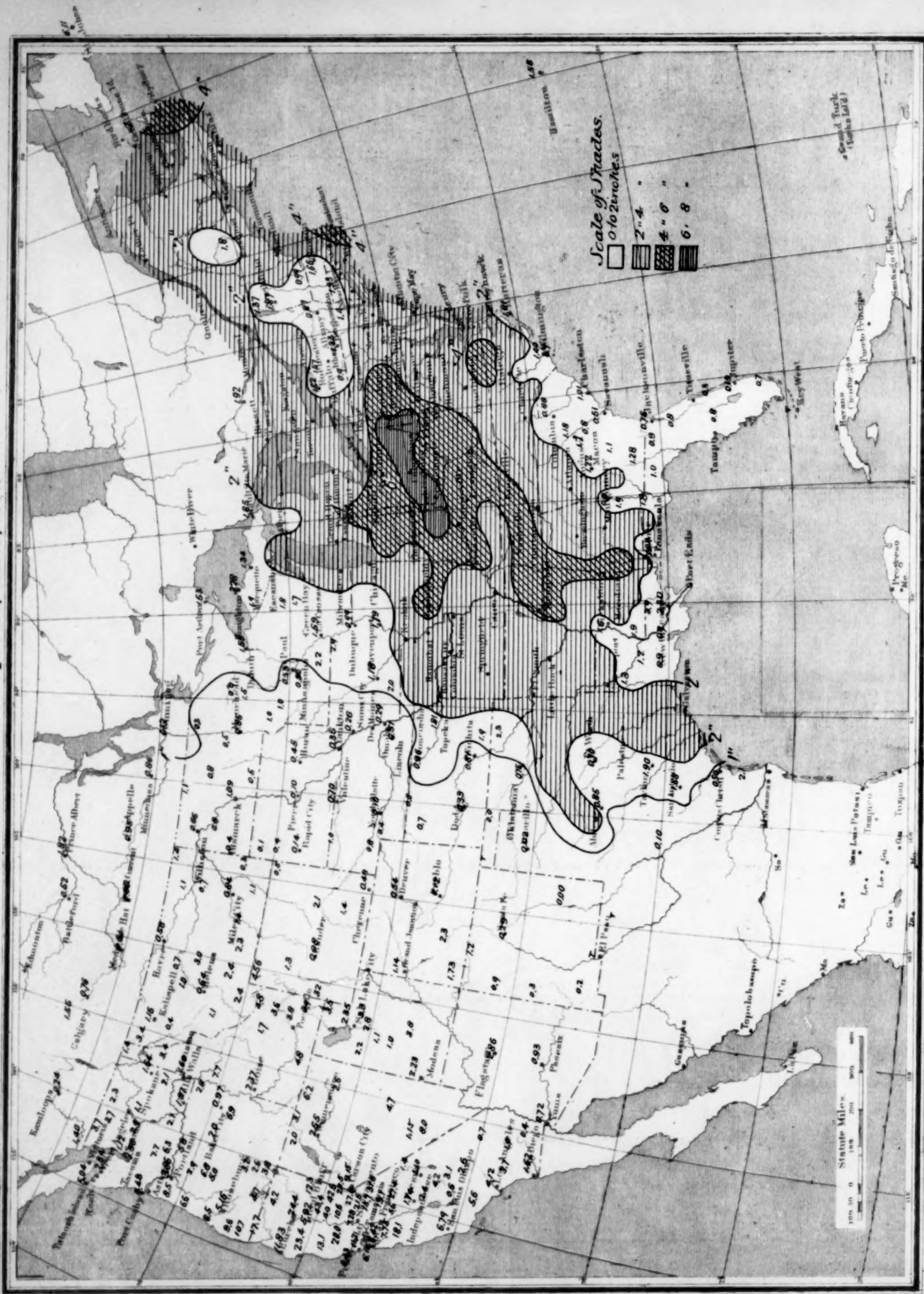
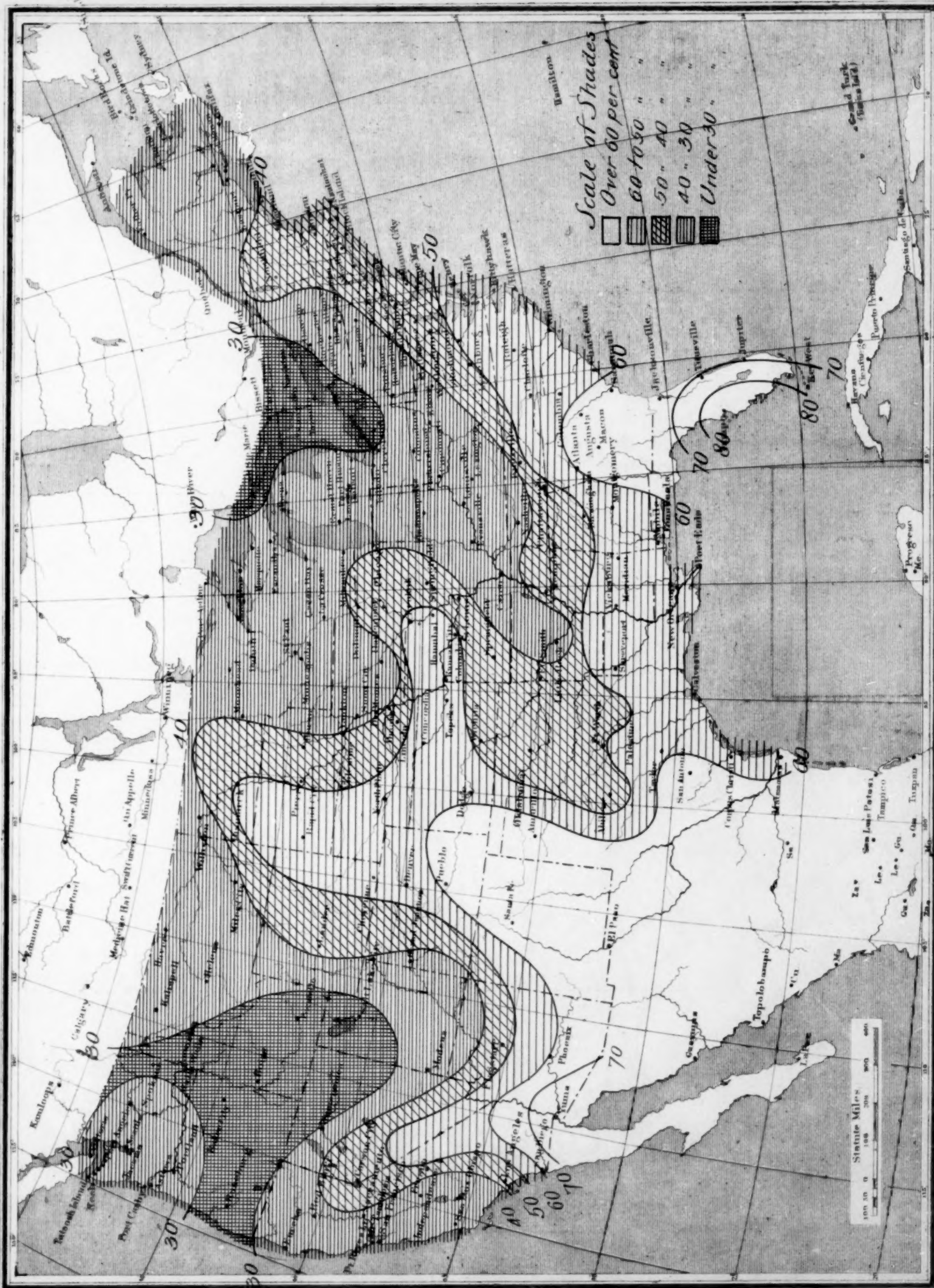


Chart IV. Total Precipitation, March, 1907.





• Barberville Chart VI. Isobars and Isotherms at Sea Level; Surface Wind Resultants, March, 1907.

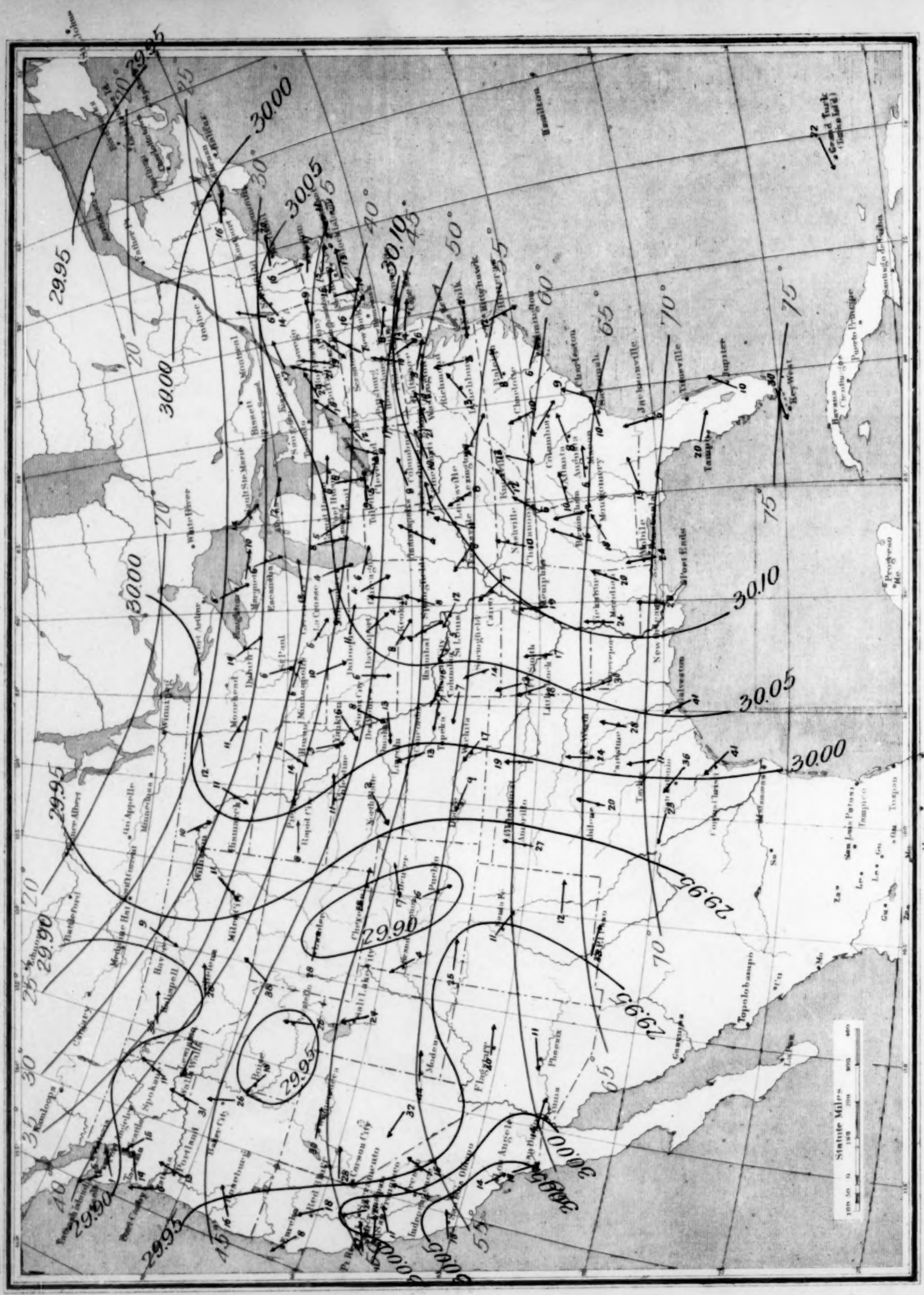
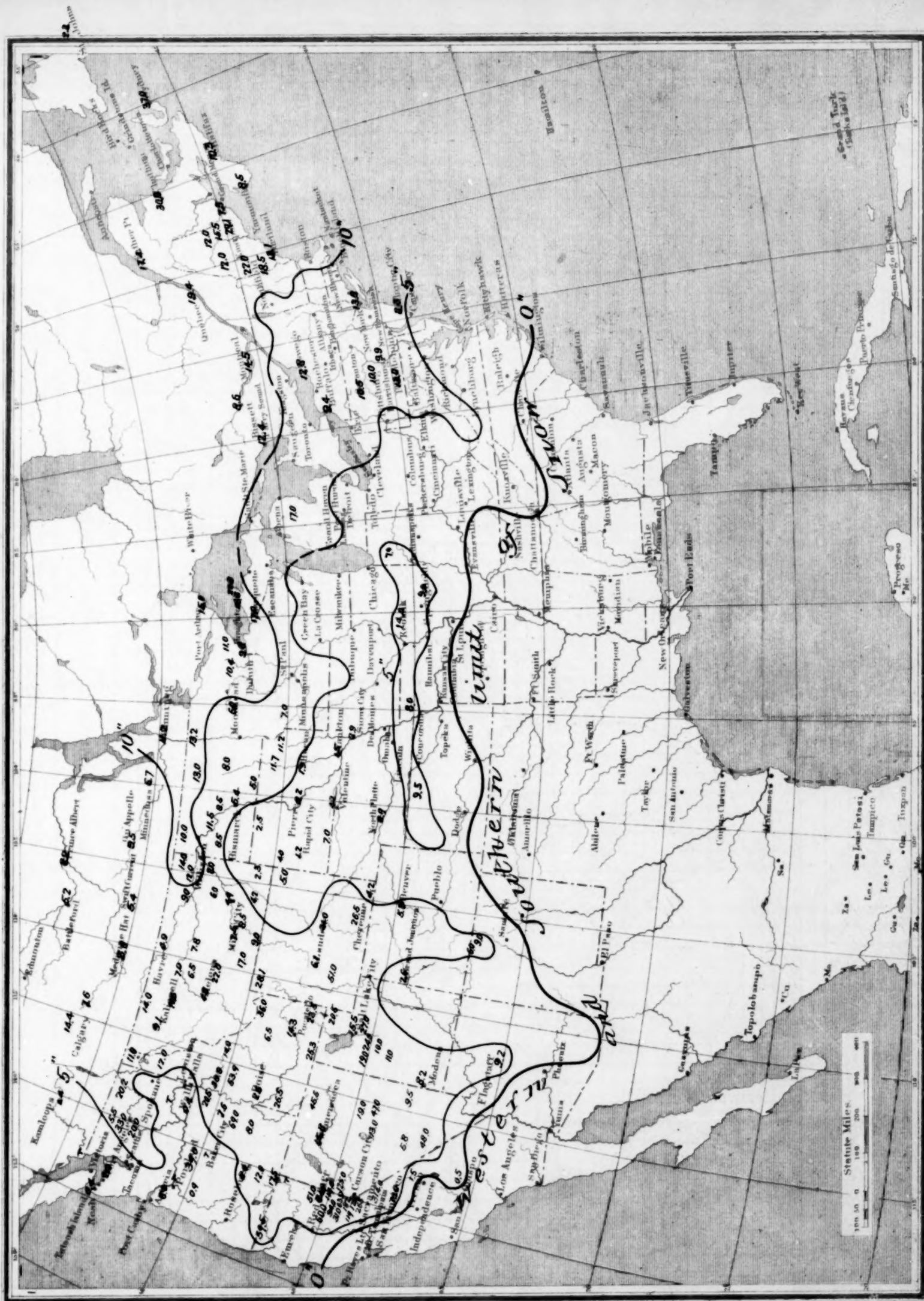


Chart VII. Total Snowfall for March, 1907.



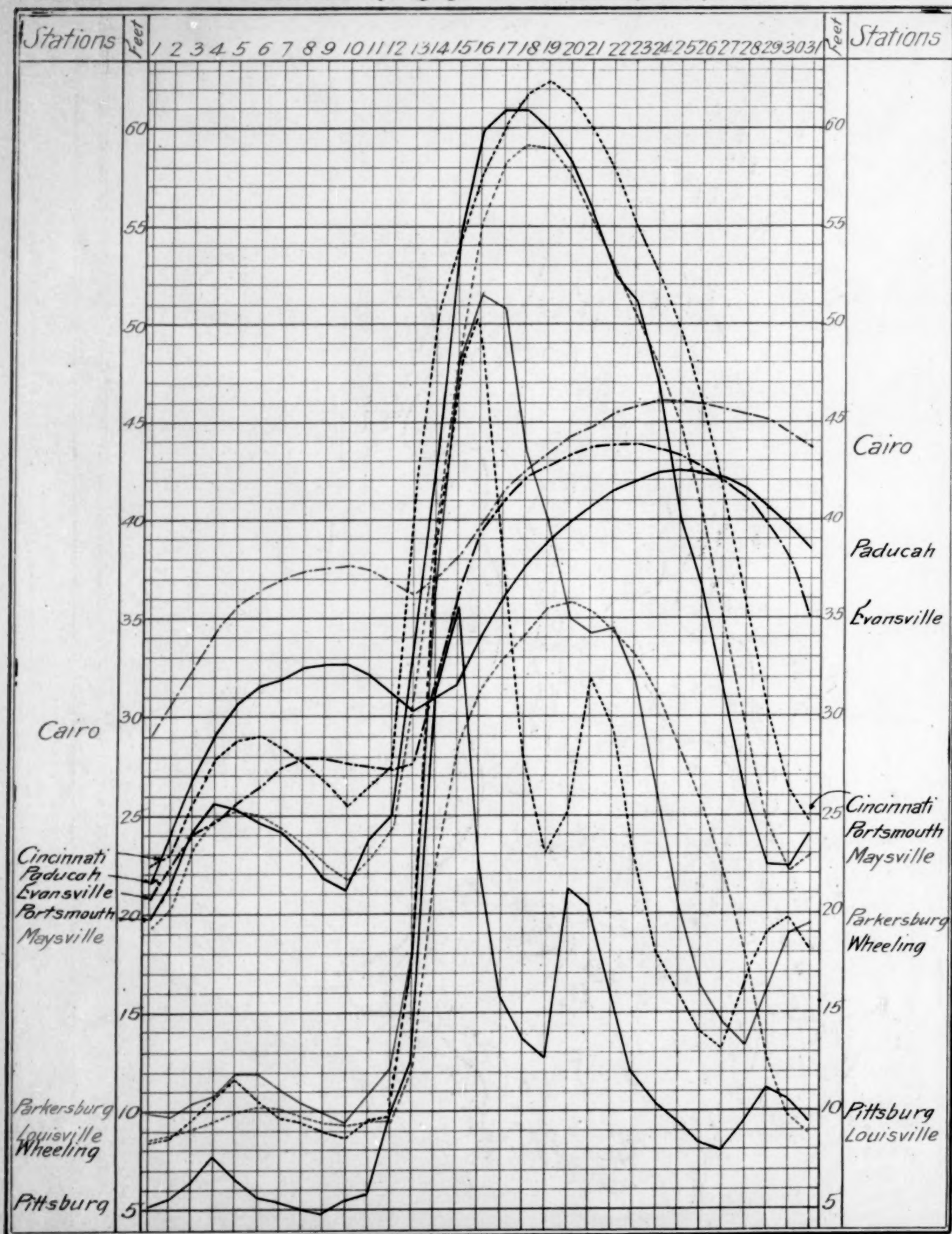


Chart X. Isobars and Winds for Greenwich Mean Noon, March 1, 1907.

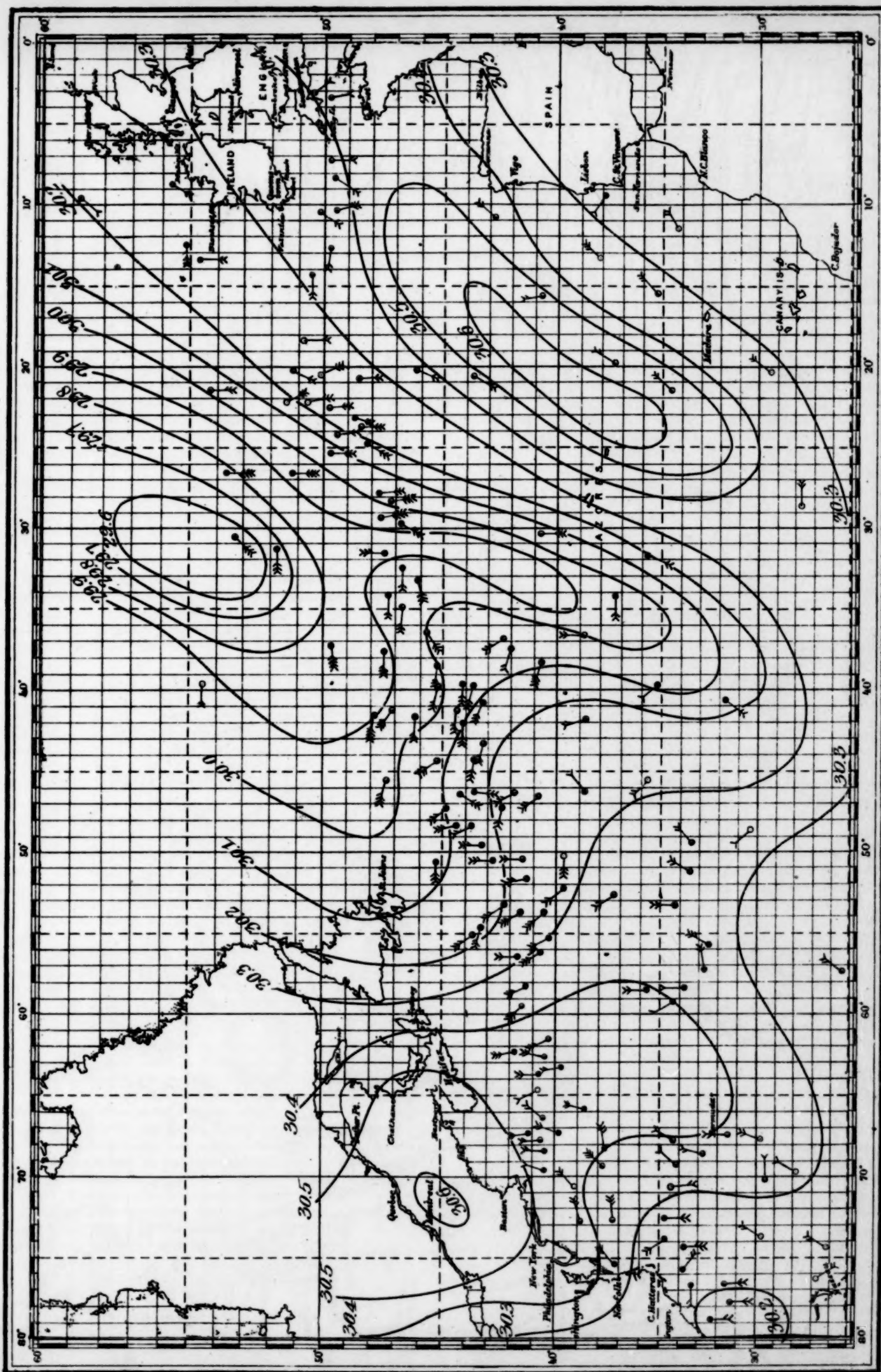


Chart XI. Isobars and Winds for Greenwich Mean Noon, March 7, 1907.

